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# OF
# SOUTH AFRICAN BOTANY

24

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# THE JOURNAL OF SOUTH AFRICAN BOTANY.

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VOLUME X, 1944.

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## CONTENTS.

PAGE

PLANTAE NOVAE AFRICANAE:

SERIES XXI. By Professor R. H. Compton, M.A.. .. .. .. .. 1
SERIES XXII. By Miss F. M. Leighton, B.Sc., and Paymaster-Captain T. M. Salter, R.N. (Ret.).. .. .. .. .. .. .. 55
SERIES XXIII. By Professor R. S. Adamson, M.A., D.Sc., Miss W. F. Barker, B.Sc., and Professor R. H. Compton, M.A.. .. .. 123

SOME NEW SPECIES AND VARIETIES IN THE GENUS HAWORTHIA. Parts II and III. By G. G. Smith. (With Plates I, II, IV) .. .. .. .. 11, 137

NOTES ON SCIRPUS AND DESCRIPTIONS OF THREE NEW SPECIES. By Mrs. M. R. Levyns, B.A., D.Sc. .. .. .. .. .. .. .. 25

ALLENIA, NEW GENUS. By Dr. E. P. Phillips, M.A., D.Sc. (With Plate III) 33

ROOT RESERVES OF SOUTH AFRICAN HIGHVELD GRASSES IN RELATION TO FERTILIZING AND FREQUENCY OF CLIPPING. By Dr. H. Weinmann, Ph.D., M.Sc. .. .. .. .. .. .. .. .. .. .. 37

NOTES ON SOME GENERA OF THE THYMELAEACEAE. By Dr. E. P. Phillips, M.A., D.Sc. .. .. .. .. .. .. .. .. .. 61

NOTES ON THE MINOR GENERA OF THE ERICACEAE. By Dr. E. P. Phillips, M.A., D.Sc. .. .. .. .. .. .. .. .. .. 69

A REVISION OF THE SOUTH AFRICAN SPECIES OF ORNITHOGALUM. Parts I and II. By Miss F. M. Leighton, B.Sc. .. .. .. .. 83, 111

NOTES ON BURCHELL'S CATALOGUS GEOGRAPHICUS, MIDDLE PORTION. By Dr. H. G. Fourcade, D.Sc. (With Plates V-VII).. .. .. .. 145

BOOK REVIEWS:

F. C. Bawden, Plant Viruses (*Dr. E. S. Moore*) .. .. .. .. 75
W. H. Schopfer, Plants and Vitamins (*Dr. W. E. Isaac*) .. .. .. 77
G. Erdtman, Pollen Analysis (*Professor R. H. Compton*) .. .. .. 80
D. R. Hoagland, Inorganic Nutrition of Plants (*Dr. W. E. Isaac*).. .. 81

INDEX TO PLANT NAMES, VOL. X, 1944 .. .. .. .. .. .. 163

# JOURNAL
# OF
# SOUTH AFRICAN BOTANY
## VOL. X.

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# PLANTAE NOVAE AFRICANAE.

## SERIES XXI.

By

R. H. COMPTON.

**Protea minor,** Compton.

Frutex procumbens. *Caules* tomentosi, glabrescentes. *Folia* linearia, base longe attenuata, mox glabrescentia, subacuta, multipunctata. *Capitulum* sessile, campanulatum, bracteis sub-8-seriatis, glabris, nitentibus, convexis, intimis pilosis, floribus subaequantibus. *Receptaculum* convexum. *Perianthium* pilosum. *Ovarium* glabrum. *Stylus* base pilosus, supra glaber, stigmate subulato.

A procumbent or semi-prostrate irregularly branched shrub reaching 100—150 cm. in diameter. Branches finely grey-tomentose when young, glabrescent. Leaves linear, widening slightly upwards, variable in length on the same shoot, up to 12 cm. long, 3—5 mm. wide, green or slightly greyish, scantily pilose when young, quickly glabrescent, inserted at nearly a right angle to the stem, all deflected to the upper side of the branch into an erect position, the midrib marked by a shallow groove on both sides, the apex subacute, the apex and margins cartilaginous, the surfaces multipunctate. Capitulum solitary, terminal, standing more or less horizontally, about 65 mm. long and 60 mm. wide when fully developed. Involucre campanulate, about 8-seriate. Basal scales broadly ovate, one or two of them with short foliar prolongations; median scales progressively longer and relatively narrower, glabrous, glossy, subobtuse, convex, coriaceous; the innermost scales linear-lanceolate, thinner in texture, appressedly silky-pilose : all scales thinly and softly white-ciliate : general colour reddish brown, the basal scales greenish with reddish edges. Flowers numerous, the younger ones clustered to a central point which slightly exceeds the involucre. Receptacle convex. Perianth spreading-villous throughout except at base with soft white hairs except for the dark brown ones at the tip, c. 30 mm. long below insertion of stamens, 15 mm. long above. Fertile anthers on short auricled filaments, 4 mm. long, the apical appendage 1 mm. long : sterile anther 5 mm. long on a slender filament 3 mm. long. Hypogynous scales deltoid, 1 mm. long. Ovary glabrous with a basal tuft of long brown straight hairs. Style pilose at base becoming glabrous towards tip, slightly bent below the stigma which is subulate and c. 5 mm. long.

*Hab.* Cape Province. Bredasdorp Division : Dunes near Elim, Oct. 1894, *Bolus* 7860 (Type, in Herb. Bolus) ; *Bolus* in Herb. Bolus 20029, July 1895 ; exhibit in Caledon Wild Flower Show, collected by Dunsdon and Langschmidt, Sept. 1931, *L. Guthrie* 242 ; exhibit in London S. African Wild Flower Show, Oct. 1933, in Herb. Bolus 20872 ; sandy edges of vlei between Bredasdorp and Elim, 25 Sept. 1933, *Leighton* in Herb. Bolus 21139 ; The Poort, near Bredasdorp, April 1933, *L. Bolus* in Herb. Bolus 20571 (old fruiting heads) ; July 1933, *van den Houten* in Herb. Bolus ; three miles west of The Poort, 3 Sept. 1943, *Compton* 14786. Caledon Division : Kleinmond, Sept. 1929, grown in National Botanic Gardens, Kirstenbosch, *L. G. Gray*, 1547/29.

This is *Protea longifolia* Andr. var. *minor* E. P. Phillips (Fl. Cap. V. i. 575, 1912), the type being *Bolus* 7860 " in dunis prope Elim, 200 ft. Oct. 1894." Since its original description it has been collected in the Bredasdorp Division several times, but owing to its striking differences from *P. longifolia* the specimens have usually remained as " incertae." Seed was obtained by the late Mr. L. G. Gray in 1929, and from this plants have been grown in the National Botanic Gardens, Kirstenbosch, where they have flowered for many years : the above description has been made chiefly from this living material.

From *P. longifolia* it differs in the procumbent or even prostrate growth of the stems, the narrow upwardly-deflected leaves, the much smaller capitulum and the correspondingly smaller dimensions of the floral parts, as well as in smaller floral details. The " miniature " flowerheads, of the general character of those of much larger species, are distinctive and attractive, although the plant as a whole is not conspicuously handsome.

Its area of distribution is mainly in the Bredasdorp Division, the Kleinmond (Caledon Division) locality of Mr. Gray's collection being the only record or observation of its occurrence there, as far as I am aware.

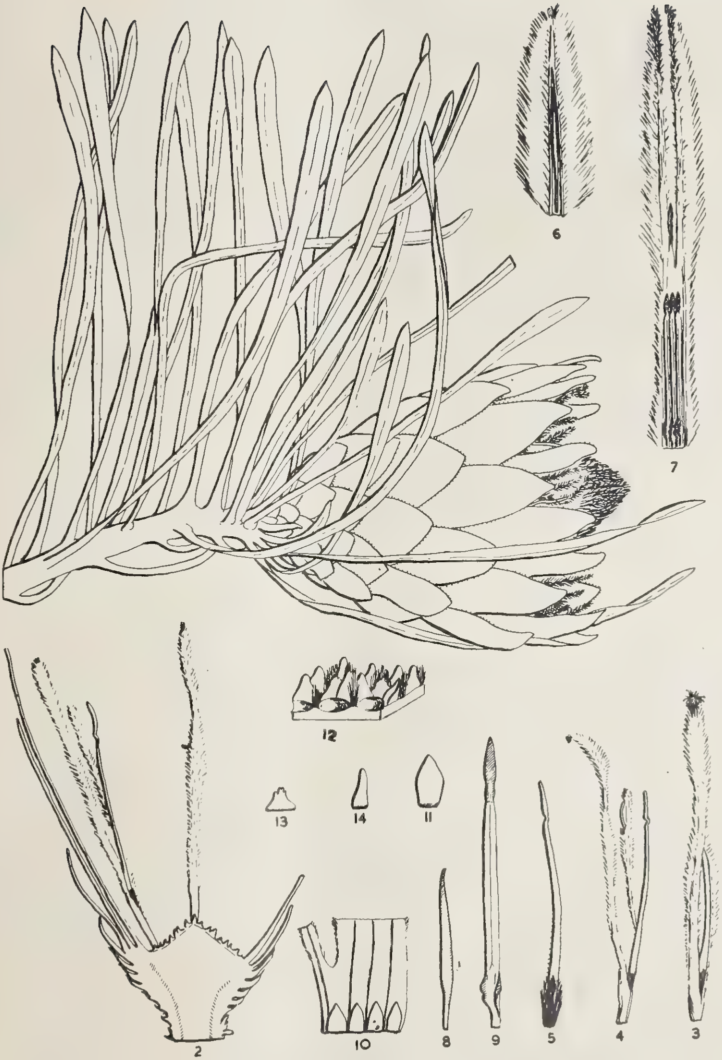

FIG. 1. *Protea minor*. 1. Flowering branch × 1. 2. L.S. Receptacle × 1. 3. Flower bud × 1. 4. Open flower × 1. 5. Gynaecium × 1. 6. Single perianth-segment with staminode × 3. 7. Triple perianth-segment with stamens × 3. 8. Staminode × 4. 9. Stamens × 6. 10. Lower part of perianth from within, with hypogynous scales × 3. 11. Hypogynous scale × 5. 12. Part of receptacle showing hypogynous scales × 5. 13, 14. Interfloral paleae × 5. (*Gray*, in Nat. Bot. Gardens 1547/29.) *Del.* E. Wasserfall.

The affinities of *P. minor* are certainly with *P. longifolia* Andr., and it would therefore fall naturally into the Section Ligulatae of the Flora Capensis. That Section, however, is defined as having large flower-heads 4—6 inches (10—15 cm.) long and flowers $2\frac{1}{2}$—$3\frac{1}{2}$ inches (6 ·3—8 ·9 cm.) long, and these dimensions are much greater than those of *P. minor*.

The possibilities of a hybrid origin were considered, but this is most improbable in view of (i) the local frequency of the plant, (ii) its relative uniformity, (iii) its copious production of good-looking pollen, (iv) the fertility of its seeds, (v) the difficulty of finding a probable fellow-parent with *P. longifolia*.

**Protea venusta.** Compton.

Frutex procumbens. *Caules* glabrescentes. *Folia* erecta, oblanceolata, glabra, coriacea, rugulosa, basin attenuata, apiculata. *Capitulum* campanulatum, erectum vel suberectum. *Bracteae* sub-7-seriatae, infimae subacutae, alterae obovato-spathulatae, perobtusae, tomentosae, apicibus rotundatis, marginibus lanato-ciliatis. *Receptaculum* subplanum. *Flores* numerosi, involucrum parum superantes. *Perianthium* base glabro, tubo piloso, apice sericeo-penicillato. *Stylus* glaber, stigmate filiforme.

A spreading procumbent shrub reaching two or three metres in diameter. Branches sub-horizontal, curved, terete, shortly grey-tomentose when young, glabrous at maturity. Leaves deflected upwards by twisting of their bases into an erect position, oblanceolate, gradually tapering to a narrow base, sub-acute, minutely apiculate, glabrous and slightly glaucous, coriaceous, rugulose, with distinct midrib and lateral venation, up to c. 60 mm. long and 18 mm. wide. Capitulum terminal, erect or sub-erect, campanulate, c. 7 cm. long, c. 7 cm. diam. Involucral bracts c. 7-seriate : the lowest sub-acute, sometimes with foliose apices : the middle and innermost obovate-spathulate, graded in size, the middle bracts up to 2 cm. wide, the innermost rather narrower and up to 5 cm. long, very obtuse and rounded at the apices, rose-pink, finely tomentose on the outer surface, the margins fringed with soft white woolly cilia. Receptacle almost flat. Flowers numerous, slightly exceeding the involucre, c. 6 cm. long. Perianth glabrous at base, softly pilose on the tube, densely tomentose on the limb with an apical tuft of soft white silky hairs : length from base to insertion of stamens c. 5 cm., thence to apex c. 1 ·2 cm. Anthers c. 9 mm. long, tipped with an ovate appendage. Hypogynous scales deltoid, 2 mm. long. Style glabrous, 5 cm. long, slightly geniculate below the slender stigma, which is 6 mm. long.

*Hab.* Cape Province. Oudtshoorn and Prince Albert Divisions : Peak near Swartberg Pass, Great Swartberg Range, 1900 m. alt., 25 Jan. 1941,

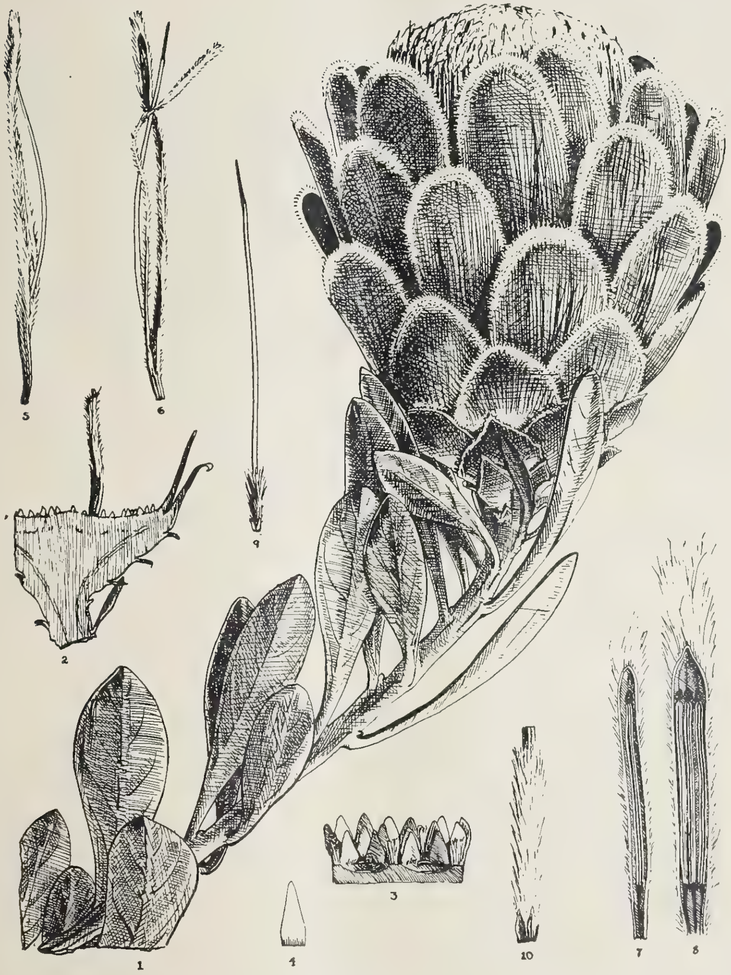

FIG. 2. *Protea venusta.* 1. Flowering branch × 1. 2. L.S. receptacle × 1. 3. Portion of receptacle, perianths removed, showing hypogynous scales × 3. 4. Hypogynous scale × 5. 5. Flower bud × 1. 6. Open flower × 1. 7, 8. Perianth segments with anthers, from within × 3. 9. Gynaecium with hypogynous scales × 1. 10. Ovary with hypogynous scales × 3. (*Compton* 10567) *Del.* M. Walgate.

*Compton* 10567 (*Type*, in Herb. Nat. Bot. Gardens) ; Swartberg Pass, Cango side, *Mathews* in Nat. Bot. Gardens 105/33 ; *Goodwin* in Nat. Bot. Gardens 2067/33 ; near Kliphuis Vlei, *Goodwin* in Nat. Bot. Gardens 2068/33 ; *Pocock* S. 130 ; *Hayter*, Jan. 1938. Uniondale Division : Mannetjeberg (Kamanassie Mts.) 2100 m. alt., 1 Feb. 1941, *Compton* 10565.

This beautiful Protea is apparently confined to mountain summits in the Swartberg and Kamanassie Ranges at an altitude of about 2000 m., where it usually grows in a south aspect. It has been noticed by several travellers who have left their vehicles at the summit of the Swartberg Pass and botanised on the neighbouring mountain slopes. Several batches of plants have been grown in the National Botanic Gardens, Kirstenbosch, from seed collected on the Swartberg. These have been planted in various situations, but although they show normal growth they flower very seldom. In the wild state the flowering plant is strikingly handsome on account of its spreading form and erect delicately coloured capitula. Its affinity is with *P. lacticolor* Salisb., from which, however, it differs considerably in its procumbent habit, larger capitulum, smaller leaves and in other details.

**Athanasia obtusa,** Compton. (Compositae-Anthemideae.) § Morysia.

Fruticulus aromaticus, ubique glaber. *Caules* rigidi, teretes. *Folia* numerosa, imbricata, late obovata, obtusa, coriacea, integra vel lobis 1 vel 2 obscuris, glanduloso-punctata. *Inflorescentia* convexo-corymbosa, densa. *Capitulum* breve pedunculatum, ellipticum : *bracteae* paucae, scariosae, obtusae, intimae laciniatae. *Flosculae* 3, tubulosae, tubo glanduloso, lobis patentibus, acutis. *Achaenia* glabra, striata, epapposa.

A small little-branched aromatic shrub, glabrous throughout. Stems terete, rigid. Leaves numerous, imbricate, erecto-patent or spreading, broadly obovate, obtuse, coriaceous, entire or with one or two obscure lobes, translucently glandular-punctate, up to about 10 mm. long × 8 mm. wide. Inflorescence terminal, compound, convex-corymbose, with up to about 80 small crowded capitula. Capitulum elliptical, on a slender bracteate peduncle. Involucre of a few unequal, rigidly scarious, obtuse, yellowish bracts, about 5 mm. long, the innermost thinner and laciniate. Florets 3, tubular, yellow, c. 5 mm. long, the tube slender, c. 2·5 mm. long, covered with stalked glands, the lobes spreading, acute, c. 1 mm. long. Achenes glabrous, striate. Pappus O.

*Hab.* Cape Province. Ceres Division : Roodeberg (Hex River Mountains), on rocks, 2100 m. alt., 19 January 1940, *Compton* 8374 (*Type*, in Herb. National Botanic Gardens) ; Matroosberg, 2300 m., *A. Bolus*, Guthrie 4409 in Herb. Bolus, 2 January 1897 ; near Laken Vlei, 1600-2000 m., January 1917, *Phillips* in Herb. S.A. Museum 11711.

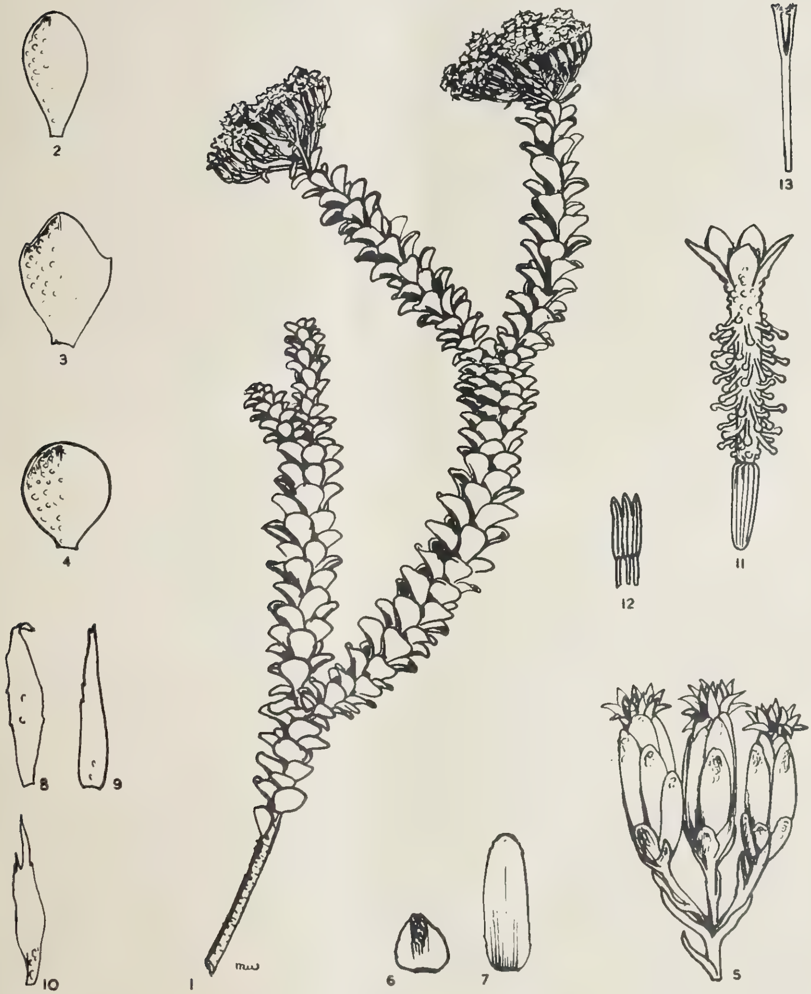

Fig. 3. *Athanasia obtusa.* 1. Plant, nat. size. 2—4. Leaves × 2. 5. Capitula × 5. 6—10. Involucral bracts × 5. 11. Floret × 10. 12. Stamens × 10. 13. Style × 10. (*Compton* 8374.) *Del.* M. Walgate.

The affinity of *A. obtusa* is with *A. spathulata* Harv., from which it differs in its numerous imbricate leaves, whose apex and lobes (when present) are obtuse and not apiculate : the capitula are fewer-flowered and smaller but more numerous than in *A. spathulata.* The locality and altitude of the two species are widely distinct, *A. spathulata* (of which I have seen the type) being based on a Drège plant from "near Groenrivier and Waterval 2500—3000 feet," i.e. near Nieuwoudtville. From *A. dentata* L. it differs in its fewer florets and glandular-hairy corolla tube.

**Aspalathus intricatus** (Garabedian MS.) Compton. (Leguminosae—Genisteae.)

Fruticulus rigidus, intricatus. *Caules* divaricati, puberuli. *Folia* fasciculata, linearia, griseo-puberula, acuta vel apiculata. *Flores* sessiles, 1 vel 2 terminales. *Bracteolae* lineares, pilosae. *Calyx* campanulatus, pilosus, lobis attenuatis tubo subaequilongis. *Corolla* mediocris, flava. *Vexillum* puberulum, *alae carinaque* glabrae. *Ovarium* pubescente, biovulatum.

A small, rigid, divaricately branched, intricate, almost spinescent shrub. Young stems sub-striate, grey-puberulous, glabrescent, the internodes c. 5—7 mm. long. Leaves fasciculate, linear, slightly curved, convex below, slightly furrowed above, acute or apiculate, grey-puberulous, 2—4 mm. long, c. 0·5 mm. wide. Flowers sessile, mostly solitary or in pairs at the ends of short lateral branches. Bracteoles linear, pilose, 2·5 mm. long. Calyx campanulate, pilose, 5 mm. long, tube and lobes about equal in length, lobes gradually tapering to fine points. Corolla of medium size for the genus, pale yellow. Vexillum erect, orbicular, c. 7 mm. long, puberulous. Alae glabrous, shortly clawed, c. 5 mm. long, 2 mm. wide. Carina free, clawed, obtuse, glabrous, 6 mm long × 2·5 mm. wide. Staminal tube c. 5 mm. long. Ovary pubescent, ovules 2.

*Hab.* Cape Province. Laingsburg Division : Witteberg near Whitehill, 1500 m., 21 October 1942, *Compton* 13937 (*Type*, in Herb. Nat. Bot. Gdns.) ; 23 October 1939, *Compton* 8015 ; 24 October 1943, *Compton* 15190 ; 1600 m., 31 October 1924, *Compton* 2686 ; Witteberg near Bantams, 1500 m., 27 October 1941, *Compton* 12179.

This and the two following species of Aspalathus were recognised as new by Miss S. Garabedian, formerly Curator of the Herbarium of the South African Museum, Cape Town. The completion of her monograph of the genus was interrupted by her departure from South Africa, and she left no descriptions of these species. I have adopted her manuscript names, which have already been taken into use in South African herbaria, and have now supplied descriptions and cited material.

I am indebted to Mrs. Fairall (Miss P. Bond), of the Kirstenbosch Herbarium staff, for a careful examination of these critical Witteberg species : her conclusions as to their novelty confirmed those of Miss Garabedian.

*Aspalathus intricatus* is closely related to *A. oxycladus*, the differences between them being pointed out under that species. (See below.) The prevailing dwarf habit of both species is probably due largely to the aridity of the locality combined with grazing by buck, hares and dassies.

**Aspalathus oxycladus** (Garabedian MS.) Compton.

Fruticulus rigidus. *Caules* erecto-patentes, pallidi, mox glabrescentes. *Folia* fasciculata, erecto-patentia, linearia, acuta vel apiculata, glabrescentia. *Flores* 1 vel 2, breviter pedicellati. *Bracteolae* lineares, pilosae. *Calyx* campanulatus, pilosus, lobis subulatis, apiculatis. *Corolla* mediocris, flava. *Vexillum* puberulum, *alae carinaque* glabrae. *Ovarium* puberulum biovulatum.

A small rigid shrub. Branches erecto-patent, sub-striate, light coloured, thinly setose when young, soon glabrescent, the internodes c. 5—7 mm. long. Leaves fasciculate, erecto-patent, linear, slightly curved, thinly setose when young, glabrescent, acute or apiculate, 3—4 mm. long, 0·3—0·5 mm. wide. Flowers solitary or in pairs, mostly terminal on short lateral shoots. Pedicel 1 mm. long, pubescent. Bracteoles linear, pilose, 2·5 mm. long. Calyx campanulate, pilose, tube 2 mm. long, lobes subulate, apiculate, 3 mm. long. Corolla of medium size for the genus, yellow. Vexillum erect or reflexed, orbicular, puberulous, c. 8 mm. long. Alae glabrous, clawed, 6 mm. long × 2 mm. wide. Carina free, clawed, glabrous, 7 mm. long × 3 mm. wide. Staminal tube c. 6 mm. long. Ovary puberulous, ovules 2.

*Hab.* Cape Province. Laingsburg Division : Witteberg near Bantams, 1500 m., 27 October 1941, *Compton* 12183 (*Type*, in Herb. Nat. Bot. Gdns.) ; Witteberg near Whitehill, 10 November 1935, *Compton* 5906 ; Pietermeintjes, southern hills opposite Station, 1150 m., December 1920, *Marloth* 9962.

Closely related to *A. intricatus*, but differing in the angle of branching, the clothing, the lighter coloured stems and greener mature leaves which are relatively more slender, the distinct pedicel and the slightly larger floral parts.

**Aspalathus rubrocalyx** (Garabedian MS.) Compton.

Fruticulus rigidus. *Caules* griseo-tomentosi, pulvinis tomentosis persistentibus. *Folia* fasciculata, subulata, sub-pungentia, glabra. *Flores* plerumque solitarii, sessiles, terminales. *Bracteolae* subulatae.

*Calyx* campanulatus, rubidus, puberulus, lobis anguste triangularibus, sub-pungentibus, tubo sub-aequilongis. *Corolla* mediocris, flava, *vexillo carinaque* puberulis, erubescentibus. *Ovarium* glabrum, biovulatum.

A small rigid shrub. Stems persistently grey-tomentose, after leaf-fall continuing to bear the conspicuous rounded grey-tomentose leaf-cushions, the internodes 2—5 mm. long. Leaves fasciculate, subulate, sub-pungent, glabrous, c. 3 mm. long. Flowers mostly solitary at the ends of short branches, sessile. Bracteoles 2 mm. long, subulate, sub-pungent. Calyx campanulate, puberulous, reddish, tube 2 mm. long, lobes narrow-triangular, sub-pungent, 2 mm. long. Corolla of medium size for the genus, yellow, flushed with red outside. Vexillum erect, broadly ovate, puberulous, c. 7 mm. long. Alae shortly clawed, 6 mm. long × 2 mm. wide. Carina clawed, obtuse, puberulous, 8 mm. long × 3 mm. wide. Staminal tube 5 mm. long. Ovary glabrous, ovules 2.

*Hab.* Cape Province. Laingsburg Division : Witteberg near Whitehill, 1500 m., 23 October 1939, *Compton* 7959 (*Type*, in Herb. Nat. Bot. Gdns.) ; 1300 m., 30 November 1924, *Compton* 2788.

Well marked by the persistent grey leaf-cushions and the hairiness and reddish tinge of calyx, vexillum and carina.

# SOME NEW SPECIES AND VARIETIES IN THE GENUS HAWORTHIA. II.

(With Plates I. & II.)

By

G. G. Smith.

**Haworthia Reinwardtii var. brevicula** G. G. Smith. (Liliaceae-Aloineae.) Sect. Coarctatae.

*Caulis foliatus* erectus, 8 cm. longus, diam. una cum foliis 38 mm., a basi proliferans.

*Folia* crebra, multifaria, ascendentia, incurvata, longa 26 mm., basi 8 mm. lata, lanceolata, acuminata ; *supra* convexa, tuberculata in 3—4 lineis longitudinalibus, opaco-viridia ; *subtus* convexa, tuberculata in 12—13 lineis transversalibus undulatis, tuberculis intra carinam oblongis, extra orbiculatis, obscure viridibus.

*Pedunculus* simplex, diam. 1½ mm., una cum racemo longus 33 cm. ; *racemus* longus 16 cm. ; *pedicelli* longi 2½ mm., diam. ¾ mm. ; *bracteae steriles* 3 ; *bracteae fertiles* longae 2 mm. ; *perianthium* longum 15½ mm., basi subglobosa diam. 3 mm. ; *ovarium* longum 2½ mm., diam. 1½ mm. ; *stylus* longus 1 mm.

*Leafy stem* erect, 8 cm. long and 38 mm. diam. including the leaves, proliferous from the base and forming clusters.

*Leaves* crowded, multifarious, ascending, incurved, 26 mm. long, 8 mm. broad at the base, 4½ mm. thick above the base, lanceolate, acuminate ; *face* convex, with a number of small raised white tubercles in 3—4 longitudinal rows in the upper half, the tubercles becoming greenish-white to concolorous below and about 1½ mm. apart in the rows, dull

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KEY TO THE DRAWINGS.

F = Leaf face.
LS = Longitudinal section.
SB = Section near base.
INF = Inflorescence.
O & S = Ovary and Stamens.
C = Capsule.

B = Leaf back.
SM = Section near middle.
ST = Section near tip.
Del. M. C. L. = Drawn by Miss M. Courtenay-Latimer.

green ; *back* rounded, tubercled in 12—13 undulated transverse rows, the tubercles round, raised, white, up to 1 mm. diam., but those on the keel oblong transversely, also arranged in 9 indistinct longitudinal rows, the transverse rows 1½—2 mm. apart at the middle of the leaf, dark green.

*Peduncle* simple, terete, 1½ mm. diam., 33 cm. long including the raceme, dark reddish-brown below ; *raceme* 16 cm. long, about 24 spirally arranged flowers and buds, 1—2 open simultaneously ; *pedicels* 2¾ mm. long, ¾ mm. diam., dark brown ; *sterile bracts* 3 ; *fertile bracts* 2 mm. long, deltoid, acuminate, light brown with a broad reddish-brown nerve ; *perianth* greyish-white, 15½ mm. long, the cylindrical-hexagonal subglobose base 3 mm. diam., oblong and hardly constricted, erect-spreading, slightly curved ; *upper segments* obtuse, the inner one straight, the 2 outer recurved ; *lower segments* obtuse, recurved, the 2 outer replicate, the inner one channelled ; *stamens* 4½ and 5 mm. long ; *ovary* 2½ mm. long, 1½ mm. diam., light green ; *style* 1 mm. long, greenish, straight, somewhat capitate.

*Habitat :* Cape Province ; Albany Division, near Fraser's Camp. (Type, *G. G. Smith* 3138, in East London Museum Herb. ; co-types in Nat. Bot. Gdns. Herb., Kirstenbosch ; Nat. Herb., Pretoria).

*Distribution :* not further known.

*H. Reinwardtii* v. *brevicula* is a small variety limited in its distribution to Fraser's Camp, where it assumes several forms. The description was made from material collected by the Author west of Fraser's Camp in Feb. 1940. It differs from the type of the species by its smallness, smaller and more crowded back tubercles, more numerous face tubercles and shorter pedicels. A neat compact little plant, and quite distinctive.

**Haworthia Reinwardtii v. grandicula** G. G. Smith. Sect. Coarctatae.

*Caulis* foliatus, longus 13 cm., diam. una cum foliis 44 mm., a basi proliferans, erectus.

*Folia* crebra, multifaria, ascendentia, incurvata, longa 38 mm., lata prope basim 11 mm., crassa 4½ mm., lanceolata, acuminata, mucronata ; *supra* convexa, plana ; *subtus* convexa, tuberculata, tuberculis albis, orbiculatis vel oblongis, diam. circiter 1 mm., in lineas transversas plus minusve undulatas instructis ornata.

*Pedunculus* simplex, diam. 1 mm., longus una cum racemo 36 cm. ; *pedicelli* longi 4 mm., diam. ¾ mm. ; *bracteae steriles* 4 ; *bracteae fertiles* longae 3 mm., deltoideae lanceolatae, acuminatae ; *perianthium* longum 19 mm., basi subglobosa diam., 3½ mm., oblonga, curvata ; *ovarium* longum 3¼ mm., diam. 1½ mm., claro-viride.

*Leafy stem* 13 cm. long and 44 mm. diam. including the leaves, proliferous from the base and forming clusters, erect.

*Leaves* crowded, multifarious, ascending, incurved, firm, 38 mm. long, 11 mm. broad near the base, 4½ mm. thick, lanceolate, acuminate, cuspidate ; *face* convex, smooth, light green below, darker green above ; *back* rounded, tubercled in 10 somewhat undulated transverse and indistinct longitudinal rows, the tubercles raised, white, round and oblong, about 1 mm. diam., mostly oblong longitudinally, but on some leaves those on

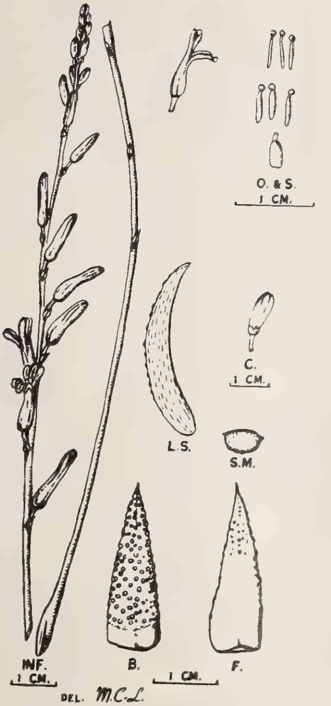


Fig. 1. H. Reinwardtii var. brevicula.

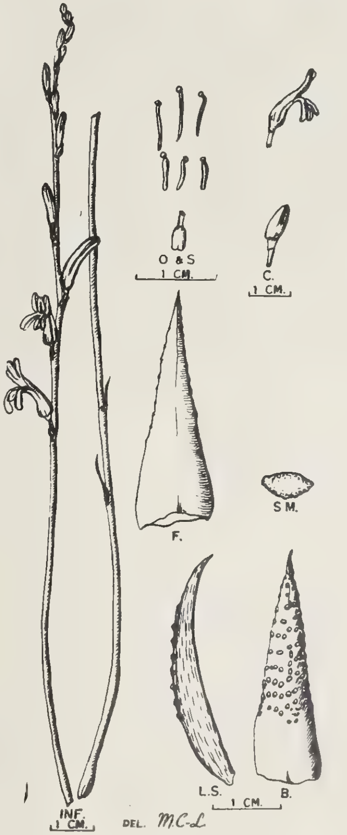


Fig. 2. H. Reinwardtii var. grandicula.

the keel or middle row oblong transversely, the transverse rows 2 mm. apart at the middle of the leaf, green below to lighter green above.

*Peduncle* simple, terete, 1 mm. diam., 36 cm. long including the raceme, light brown below ; *raceme* about 11 cm. long, about 15 spirally arranged flowers and buds, 1—2 open simultaneously ; *pedicels* 4 mm. long, ¾ mm. diam., greenish-brown ; *sterile bracts* 4 ; *fertile bracts* 3 mm. long, deltoid lanceolate, acuminate, white, with a fine reddish-brown nerve ; *perianth* white, 19 mm. long, the 1½ mm. long tapering-stipitate sub-globose cylindrical-hexagonal base 3½ mm. diam., constricted to 3 mm. diam., oblong, curved ; *upper segments* obtuse, straight to slightly recurved, equal in length ; *lower segments* obtuse, very recurved, the 2 outer replicate, the inner one channelled ; *stamens* 5 and 6½ mm. long ; *ovary* 3¼ mm. long, 1½ mm. diam., bright green ; *style* 1 mm. long, straight.

*Habitat :* Cape Province ; Peddie Division, east of Kaffir Drift (Type, *G. G. Smith*, 3363, in East London Museum Herb. ; co-types in Nat. Bot. Gdns. Herb., Kirstenbosch ; Nat. Herb., Pretoria).

*Distribution :* not further known.

This variety was collected by Miss M. Courtenay-Latimer near Kaffir Drift, in the Peddie district, in May, 1941. In the typical form of *H. Reinwardtii* Haw., the face of the leaf is smooth or with a few tubercles arranged in rows mostly along the middle. This variety is a smaller plant, the leaf face is perfectly smooth, the back has fewer transverse rows of tubercles and these rows are further apart at the middle of the leaf. Its nearest ally is var. *peddiensis*, which plant however is somewhat smaller, has shorter and broader leaves with a tubercled face, and the flowers and fertile bracts are shorter.

**Haworthia Reinwardtii v. huntsdriftensis** G. G. Smith. Sect. Coarctatae.

*Caulis* foliatus, 17 cm. longus, diam. una cum foliis 40 mm., a basi proliferans.

*Folia* ascendentia, incurvata, longa circiter 38 mm., lata 14 mm., lanceolata, acuminata ; *supra* basim versus plana, apicem versus convexa, laevia, pallide viridia vel pulliora ; *subtus* convexa, tuberculis parvis, albis, prominentibus, transversaliter oblongatis, in lineas 11 transversales instructis ornata, fusco-viridia.

*Pedunculus* simplex, diam. 1 mm., longus una cum racemo 30 cm. ; *pedicelli* longi 3 mm., diam. vix 1 mm. ; *bracteae steriles* 2, longi 5 mm. ; *bracteae fertiles* longae 2 mm., deltoideae, acutae ; *perianthium* longum

17 mm., diam. 4 mm. ; *stamina* longa 6 et 7 mm. ; *ovarium* longum 3½ mm., diam. 2 mm., claro-viridia ; *stylus* longus 1 mm. vel amplius.

*Leafy stem* 17 cm. long and 40 mm. diam. including the leaves, sub-erect, proliferous from the base and forming clusters.

*Leaves* crowded, spirally arranged, multifarious, ascending, incurved, firm, about 38 mm. long, 14 mm. broad near the base, 5 mm. thick at the middle, lanceolate, acuminate ; *face* flat below, flat-rounded above, smooth, with a raised concolorous longitudinal middle line and one on each side meeting the middle line about 6 and 9 mm. respectively below the tip, light to dark green ; *back* rounded, obliquely keeled in the upper 2/3, beset with 11 transverse rows of raised, white, transversely oblong rather small tubercles, a number of which are confluent transversely, and regularly arranged on the keel, the rows 2¼ mm. apart at the middle of the leaf, dark green.

*Peduncle* simple, terete, 1 mm. diam., including the raceme 30 cm. long, light reddish-green below ; *raceme* about 13 cm. long, about 14 spirally arranged flowers and buds, 2 open simultaneously ; *pedicels* 3 mm. long, barely 1 mm. diam., greyish-brown ; *sterile bracts* 2, the lowest 11 cm. from base, 3—5 mm. long ; *fertile bracts* 2 mm. long, deltoid acute, light brown with a broad very dark brown nerve ; *perianth* pinkish-white, 17 mm. long, the 4 mm. diam. shortly stipitate (1 mm.) cylindrical-hexagonal sub-globose base constricted to 3¼ mm. above, oblong, erect, curved ; *upper segments* obtuse, face colour of the 2 outer pinkish-white with a broad greenish-brown nerve, recurved, face colour of the inner segment white above, light green below, with a broad greenish brown nerve, recurved ; *lower segments* obtuse, the face colour of the 2 outer white above, greenish below, with a fine greenish-brown nerve, replicate and recurved at an angle of about 45°, the face colour of the inner segment pink with a medium fine greenish-brown nerve, channelled, more recurved and longer ; *stamens* 6 and 7 mm. long ; *ovary* 3½ mm. long, 2 mm. diam., bright green ; *style* fully 1 mm. long, white, somewhat bent.

*Habitat :* Cape Province ; Albany Division. (Type, *G. G. Smith*, 3849, in East London Museum Herb. ; co-types in Nat. Bot. Gdns. Herb., Kirstenbosch ; Nat. Herb., Pretoria).

*Distribution :* not further known.

The name of *huntsdriftensis* commemorates Hunt's Drift, on the Fish River, which in this locality separates the Albany from the Peddie District. At Kaffir Drift some miles lower down the river, there are a number of distinct varieties of *H. Reinwardtii*, but at Hunt's Drift, the type locality for *H. Reinwardtii v. huntsdriftensis*, this is the only one on record. This plant was discovered by the Author in Dec., 1940, a few miles west to south-west of the drift. Compared with *H. Reinwardtii* Haw., the tubercles are smaller and less numerous on back of leaf and the face is quite smooth. In general appearance it resembles var. *committeesensis*, but the back tubercles are smaller and more sparsely arranged, the leaves shorter and more incurved at the apex and the fertile bracts are shorter.

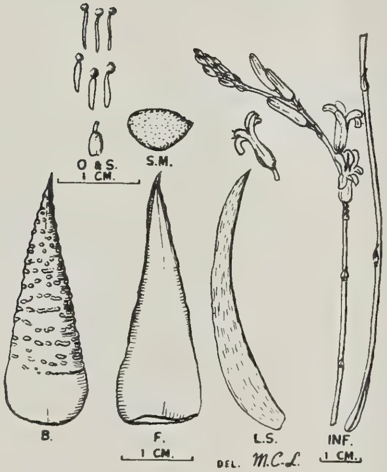


FIG. 3. H. Reinwardtii var. huntsdriftensis.

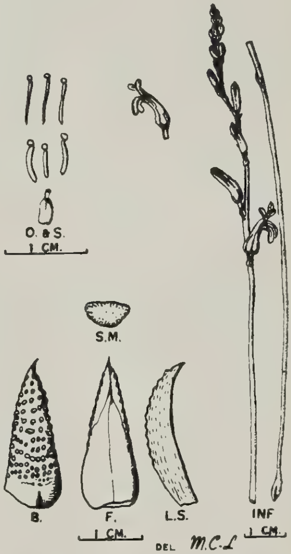


FIG. 4. H. Reinwardtii var. riebeekensis.

**Haworthia Reinwardtii var. riebeekensis** G. G. Smith. Sect. Coarctatae.

*Caulis foliatus* longus usque ad 8 cm., diam. una cum foliis 30 mm., a basi proliferans.

*Folia* multifaria, longa 20 mm., lata usque ad 10 mm., ovata, acuta ; *supra* plana vel convexa, claro-viridia, laevia ; *subtus* convexa, tuberculis parvis albidis orbiculatis vel oblongatis in lineas 10—11 longitudinales ordinatas aut 9—12 transversales inordinatas instructis percursa.

*Pedunculus* simplex, diam. 1 mm., circiter longus 24 cm., una cum racemo 18 floribus sublaxis ornato ; *pedicelli* longi 3 mm., diam. 1 mm. ;

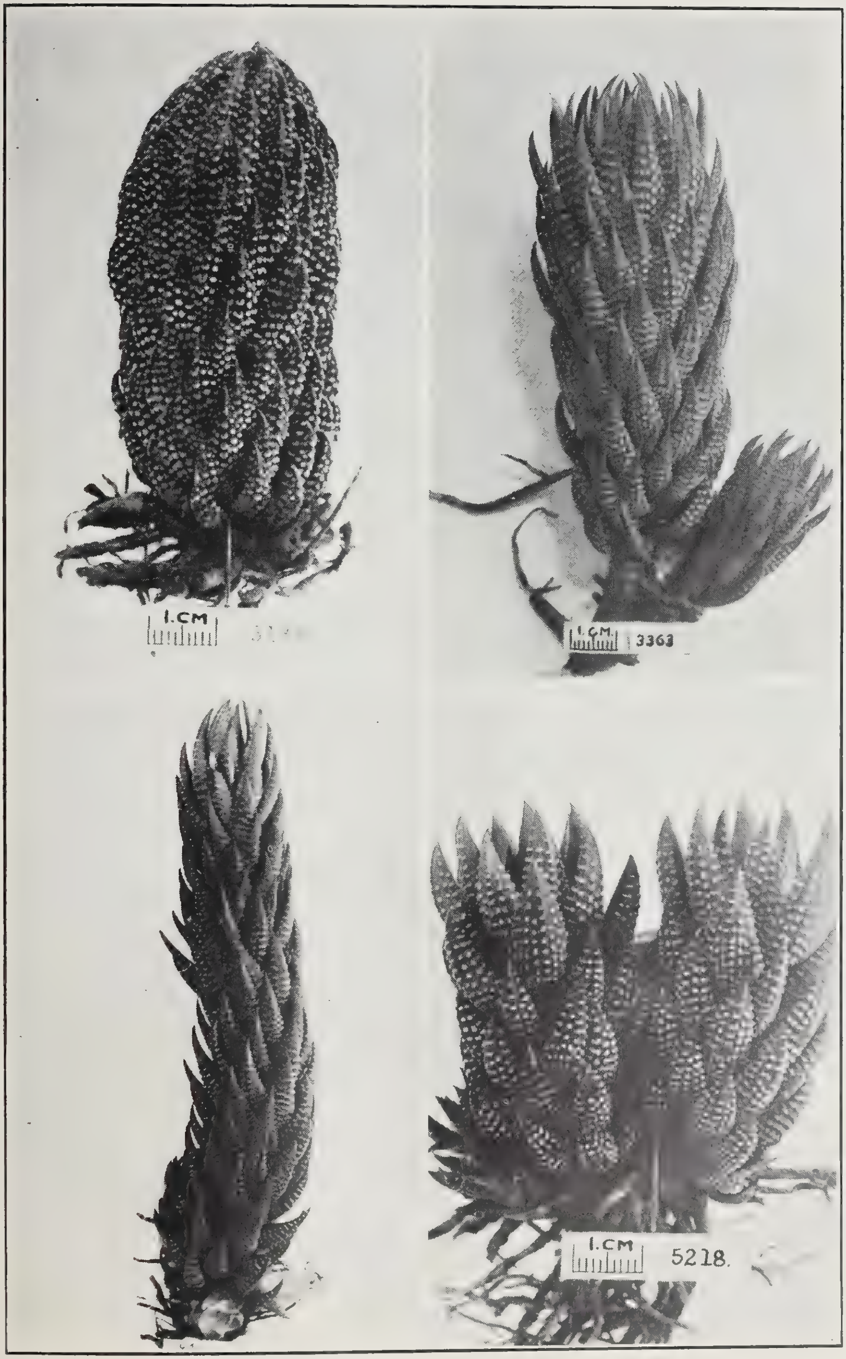
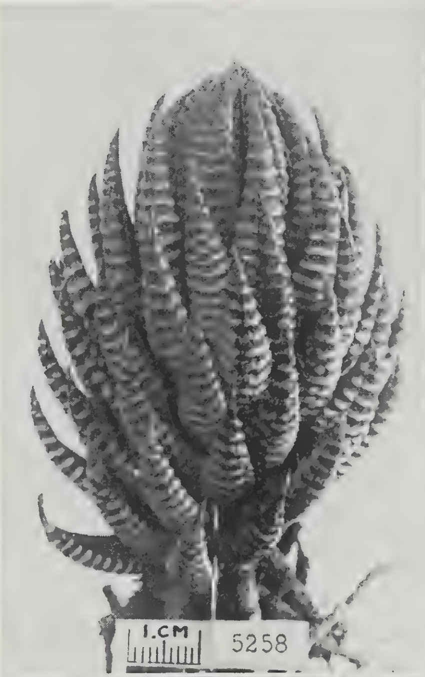
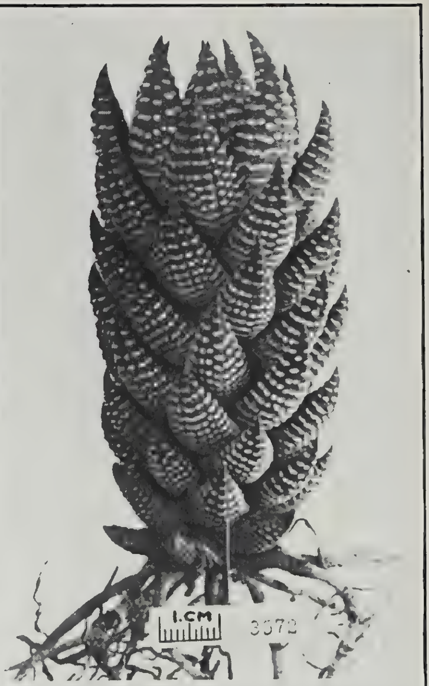
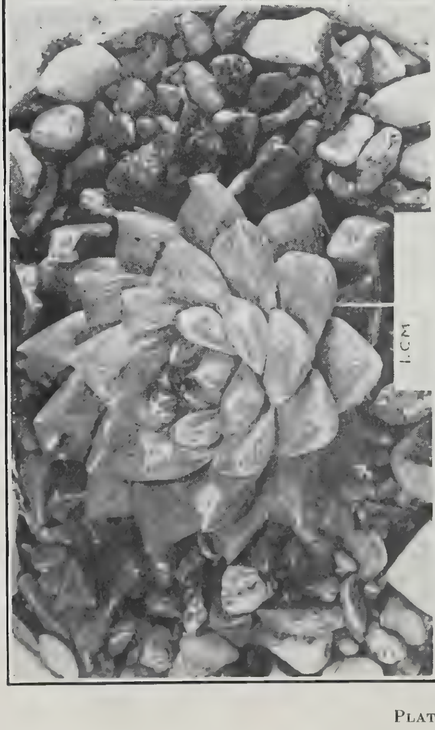


PLATE I.

1. H. Reinwardtii var. brevicula.
2. H. Reinwardtii var. grandicula.
3. H. Reinwardtii var. huntsdriftensis.
4. H. Reinwardtii var. riebeekensis.







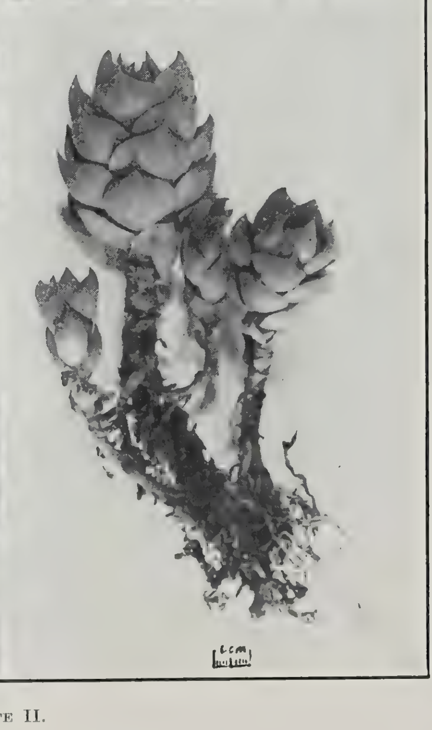


PLATE II.

5. H. Reinwardtii var. zebrina.
6. H. baccata.
7. H. lepida.
8. H. ramosa.

*bracteae steriles* 2 ; *bracteae fertiles* longae 3 mm. ; *perianthium* album, longum 15 mm., basi subglobosa diam. 3 mm., claro-viride ; *stylus* longus 1 mm.

*Leafy stem* 8 cm. long and 30 mm. diam. including the leaves, proliferous from the base and forming clusters.

*Leaves* multifarious, ascending ± spreading, incurved near the tip, firm, 20 mm. long, up to 10 mm. broad near the base, up to 6 mm. thick, ovate lanceolate, acute ; *face* flat to rounded, smooth, bright light green ; *back* rounded, with small whitish round and oblong tubercles arranged in 10—11 regular longitudinal and 9—12 irregular transverse rows, the tubercles ½ mm. diam. at middle of leaf and smaller above and below, seldom confluent, oblong transversely and longitudinally, the transverse rows about 1¼ mm. apart at the middle of the leaf, darker than face ; *keel* ± oblique, 1/3 from the tip.

*Peduncle* simple, terete, 1 mm. diam., about 24 cm. long including the raceme, brown below ; *raceme* sub-laxly 18 flowered, about 6½ cm. long, flowers spirally arranged, 1 open at a time ; *pedicels* 3 mm. long, 1 mm. diam., erect, dark greenish-brown ; *sterile bracts* 2, about 3 mm. long ; *fertile bracts* 3 mm. long, ovate-deltoid, acuminate, reddish with a medium-fine dark brown nerve ; *perianth* white, brown nerved, 15 mm. long, the triangular-hexagonal subglobose base 3 mm. diam., ± tapering to pedicel, oblong, erect, curved ; *upper segments* obtuse, channelled, face colour of the 2 outer white with a medium-fine greenish-brown nerve, recurved about 90°, spreading, face colour of the inner segment white at tip, greenish below, with a broad greenish-brown nerve, not recurved ; *lower segments* obtuse, face colour of the 2 outer white at tip, greenish below, with a broad greenish-brown nerve, replicate, very recurved, ± spreading, face colour of the inner segment pinkish-white with a medium-fine greenish nerve, channelled, ± revolute ; *stamens* 5 & 6 mm. long ; *ovary* 3 mm. long, 1½ mm. diam., bright light green ; *style* 1 mm. long, greenish-white, straight, not or hardly capitate.

*Habitat :* Cape Province ; Albany Division (Type, *G. G. Smith*, 5218 in East London Museum Herb. ; co-types in Nat. Bot. Gdns. Herb., Kirstenbosch and Nat. Herb., Pretoria.)

*Distribution :* not further known.

This beautiful variety was collected by the Author in January, 1942, near Riebeek, in the Albany District. It is not too plentiful. In appearance and colour it is nearest allied to *H. Reinwardtii v. adelaidensis* v.P., but is a smaller plant and the tubercles are in longitudinal rows, whereas those of *v. adelaidensis* are in transverse rows.

**Haworthia Reinwardtii v. zebrina** G. G. Smith. Sect. Coarctatae.

*Caulis foliatus*, simplex, altus usque ad 14 cm., diam. una cum foliis 55 mm., proliferans.

*Folia* ascendentia, longa circiter 50 mm., ad basim lata 12 mm., incurvata, lanceolata, acuminata ; *supra* convexa, parte superiore tuberculis paucis parvis albidis vel concoloribus immersis orbiculatis ornata, basim versus claro-viridia, apicem versus pulliora, nitentia; *subtus* convexa, fusco-viridia, tuberculis argenteis plerumque confluentibus in 12—15 lineas transversales instructis percursa.

*Pedunculus* simplex, diam. vix 2 mm. ; *pedicelli* longi $1\frac{1}{8}$ mm. ; *bracteae steriles* 3, longae 6 mm. ; *bracteae fertiles* longae $3\frac{1}{4}$ mm., deltoideae, acutae ; *perianthium* album, longum 20 mm. ; *ovarium* longum $3\frac{1}{2}$ mm. ; *stylus* longus $1\frac{1}{4}$ mm.

*Leafy stem* simple, erect, up to 14 cm. tall and 55 mm. diam. including the leaves, proliferous from the base and forming clusters.

*Leaves* spirally arranged, ascending, multifarious, firm, about 50 mm. long, 12 mm. broad near the base, 6 mm. thick below the middle, incurved, lanceolate, acuminate ; *face* rounded, with a raised concolorous middle line from near the base to the tip, and a second one from near the margin near base of leaf and meeting the middle line above the middle of leaf, beset with a few small whitish to concolorous immersed round tubercles in the upper $\frac{1}{3}$, light green at the base and darker green above, shining; back rounded, dark green, with 12—15 transverse rows of silvery white round and oblong prominent tubercles most of which are confluent in long transverse bands in the upper half of the leaf, towards the base smaller and solitary, the transverse rows $2\frac{1}{2}$—3 mm. apart at the middle of the leaf.

*Peduncle* simple, ± terete, barely 2 mm. diam. near the base, including the raceme 39 cm. long, light brown ; *raceme* $14\frac{1}{2}$ cm. long, about 26 flowers and buds, ± sparsely and spirally arranged, 1—3 open simultaneously ; *pedicels* $2\frac{3}{4}$ mm. long, $1\frac{1}{8}$ mm. diam., brown ; *sterile bracts* 3, 6 mm. long, the lowest one $13\frac{1}{2}$ cm. from the base of peduncle ; *fertile bracts* $3\frac{1}{4}$ mm. long, deltoid, acute, dull white with a fine brown nerve ; *perianth* white, 20 mm. long, the cylindrical-hexagonal sub-globose base 5 mm. diam., tapering to the pedicel, slightly constricted above to $4\frac{3}{4}$ mm., oblong, erect-spreading, spirally arranged, the tube curved ; *segments :* face towards the tips white, with a broad greenish to greenish-brown nerve, the upper ones obtuse, channelled, the middle one slightly recurved, the outer recurved about 90°, somewhat spreading ; the lower segments obtuse, the middle one channelled, somewhat revolute, the outer ones replicate, recurved about 105°, spreading ; *stamens* $5\frac{1}{2}$ and $6\frac{1}{2}$ mm. long ;

*ovary* 3½ mm. long, barely 2 mm. diam., green; *style* 1¼ mm. long, straight, hardly capitate.

*Habitat:* Cape Province; Peddie Dist. (Type, *G. G. Smith*, 5258, in the East London Museum Herb.; co-types in Nat. Bot. Gdns. Herb., Kirstenbosch and Nat. Herb., Pretoria.)

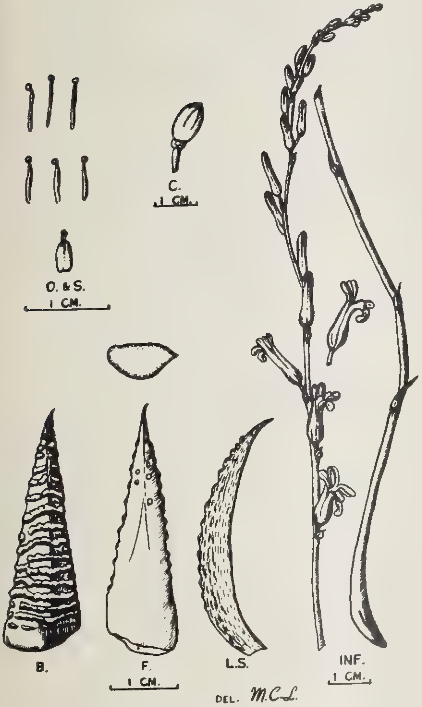


Fig. 5. H. Peinwardtii var. zebrina.

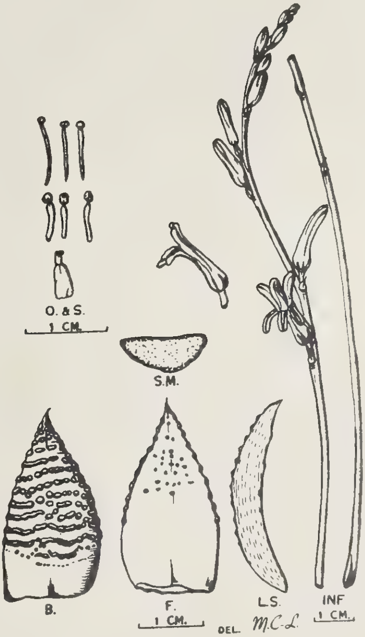


Fig. 6. H. baccata.

*Distribution:* not further known.

This distinctive variety was collected by the Author in Feb., 1942, on the Fish River slopes, south-east of Kaffir Drift. It differs from the species or any of the varieties by the transversely confluent prominent tubercles.

**Haworthia baccata.** G. G. Smith. Sect. Coarctatae.

*Caulis* foliatus simplex, altus circiter 10 cm., diam. una cum foliis 40 mm., proliferans.

*Folia* ascendentia, longa circiter 30 mm., super basim lata 16 mm., incurvata, ovata, acuta ; *supra* concava, tuberculis oblongatis parvis albidis concoloribus in parte superiore ornata ; *subtus* convexa, pallide viridia, apicem versus fuscido-viridia, tuberculis albis diam. 1 mm., in 12 lineas transversales plus minusve undulatas instructis ornata.

*Pedunculus* simplex, diam. $1\frac{1}{4}$ mm. ; *racemus* longus 9 cm. ; *pedicelli* longi $4\frac{1}{2}$ mm., diam. 1 mm. ; *bracteae steriles* 2, longae 5 mm. ; *bracteae fertiles* longae 3 mm., deltoideae, acuminatae, albae ; *perianthium* roseo-album, longum 23 mm.

*Leafy stem* simple, erect, about 10 cm. tall and 40 mm. diam. including the leaves, proliferous from the base and forming clusters.

*Leaves* spirally arranged, ascending, multifarious, firm, about 30 mm. long, 16 mm. broad above the base, 5 mm. thick at the middle, incurved, ovate, acute ; *face* flat to concave, beset with small whitish and concolorous transversely oblong tubercles in the upper $\frac{1}{3}$ and arranged on and alongside the slightly raised concolorous middle longitudinal line, light green below, darker green above ; *back* rounded, light green, becoming brownish-green towards the tip, with 12 somewhat undulated transverse rows of white, 1 mm. diam., round and transversely oblong tubercles which are often confluent at the middle, solitary and smaller towards the tip and very small towards the base, also arranged in 12 indistinct longitudinal rows, the transverse rows 2 mm. apart at the middle of the leaf.

*Peduncle* simple, terete, $1\frac{3}{4}$ mm. diam., including the raceme 29 cm. long, rich brown ; *raceme* 9 cm. long, about 11 flowers and buds, sparsely and spirally arranged, 1 open at a time ; *pedicels* $4\frac{1}{2}$ mm. long, 1 mm. diam., light reddish-brown ; *sterile bracts* 2, 5 mm. long, the lower one 11 cm. from the base of peduncle ; *fertile bracts* 3 mm. long, deltoid, acuminate, white, with a broad dark brown nerve ; *perianth* pinkish-white, 23 mm. long, the cylindrical-hexagonal shortly stipitate subglobose base 5 mm. diam., slightly constricted above to $4\frac{1}{2}$ mm., oblong, erect-spreading, the tube slightly curved ; *upper segments* obtuse, channelled, the inner one slightly recurved, face colour pinkish-frosty-white with the nerve fine and greenish-brown above, the 2 outer segments more recurved, spreading, face colour pale pink with a broad greenish-brown nerve ; *lower segments* obtuse, the inner one channelled, long recurved, face colour pink with a medium-fine greenish-brown nerve, the 2 outer segments replicate, more recurved, spreading, face colour frosty-white with a broad greenish-brown nerve ; *stamens* 6—8 mm. long ; *ovary* $4\frac{1}{2}$ mm. long, $2\frac{1}{4}$ mm. diam. below, bright light green ; *style* $1\frac{1}{2}$ mm. long, straight, slightly capitata.

*Habitat :* Cape Province ; Stutterheim Dist., about 9 miles S.W. of Stutterheim. (Type *G. G. Smith* 3572, in East London Museum Herb. ; co-types in Nat. Bot. Gdns. Herb., Kirstenbosch ; Nat. Herb., Pretoria.)

*Distribution :* not further known.

This distinctive species is described from plants sent to the Author by Mr. G. McLaren of King Williamstown. It is said to have been collected by a friend of his at Isidenge, about 9 miles S.W. of Stutterheim. Once one has become acquainted with this Haworthia, it is not likely to be confused with other Haworthias so far recorded. While somewhat similar in shape and habit to *H. Chalwinii* Marl. et. Berger, the conspicuously pearl-like back tubercles is a character upon which the two plants may be easily and accurately separated. *H. baccata* has large flowers and the stamens and ovaries are long. This is the most north-easterly plant on record in the Sect. Coarctatae.

**Haworthia lepida** G. G. Smith. Sect. Obtusatae.

*Planta* acaulis, folia circiter 46, diam. 6 cm., proliferans.

*Folia* tenera, longa 20—30 mm., lata apicem versus 13—16 mm., obovato-oblongata, late acuta ; *supra* convexa, lineis 7 indistincte reticulatis percursa ; *subtus* convexa, lineis 11 indistincte reticulatis percursa ; *carina marginesque* non denticulati.

*Pedunculus* simplex, diam. $1\frac{3}{4}$ mm., longus una cum racemo 15 cm. ; *pedicelli* longi $1\frac{3}{4}$ mm., ovati, $1\frac{1}{2}$ mm. × 1 mm. ; *bracteae steriles* 8, longae 5 mm. ; *bracteae fertiles* longae 4 mm. ; *perianthium* longum 17 mm. ; *ovarium* longum $2\frac{3}{4}$ mm., diam. $1\frac{1}{4}$ mm. ; *stylus* longus $\frac{3}{4}$ mm., flexus.

*Plant* stemless, about 46 leaves in a dense rosette 6 cm. diam., 3 cm. tall, proliferous from the base and forming dense clusters.

*Leaves* crowded, the young ascending, the old spreading, tender, 20—30 mm. long, 13—16 mm. broad about $\frac{1}{3}$ from tip, 12—13 mm. broad at base, 6—8 mm. thick above middle, obovate-oblong, broadly acute, the naked pellucid end-awn $\frac{3}{4}$ mm. long ; *face* rounded, somewhat swollen near tip, smooth, sometimes with a few longitudinally oblong pellucid spots near the tip or pellucid near tip and along margins, and with 7 indistinctly reticulate lines the middle one reaching the tip, light green, dull ; *back* rounded, swollen near the tip, with a few longitudinally oblong spots near the tip, these longer on the keel, and with 11 indistinctly reticulate lines three of which reach the tip, darker green than face, dull ; *keel* obtuse, somewhat oblique, pellucid towards the tip, entire ; *margins* acute below, blunt and broadly pellucid in the upper ⅓, entire.

*Peduncle* simple, terete, 1¾ mm. diam., light greenish-brown below, 15 cm. long including the 3 cm. long raceme, about 16 spirally arranged flowers and buds, one flower open at a time ; *pedicels* 1¾ mm. long, 1½ by 1 mm., elliptical oval, erect, green ; *sterile bracts* 5 mm. long, 8, the lowest 3¼ cm. from base of peduncle ; *fertile bracts* 4 mm. long, deltoid, acute, white, with a fine green nerve ; *perianth* white, brown nerved, 17 mm. long, the cylindrical-triangular base 4¼ mm. diam. across, constricted to 3½ mm. above, ovate-oblong, curved, spreading ; *upper perianth segments* obtuse, channelled, the inner one slightly recurved, the face colour white becoming brownish below and with a fine greenish-brown nerve, the 2 outer segments shortly revolute, spreading, the face white and with a fine reddish-brown nerve ; *lower segments* obtuse, the inner one somewhat flat, revolute, the face colour white with a fine reddish-brown nerve, the 2 outer segments deeply channelled, recurved about 90°, spreading, the face colour white, with a greenish-brown nerve which is fine above and broad below ; *stamens* 4 and 5 mm. long ; *ovary* 2¾ mm. long, 1¼ mm. diam., light brown ; *style* ¾ mm. long, bent, capitate.

*Habitat :* Cape Province ; Albany District, between Carlisle Bridge and Fort Brown, on the Fish River, on a krantz facing south. (Type, *G. G. Smith* 5066, in East London Museum Herb. ; co-types in the Nat. Bot. Gdns. Herb., Kirstenbosch ; Nat. Herb., Pretoria.)

*Distribution :* not further known.

This very attractive plant was discovered in May, 1941, by Miss M. Courtenay-Latimer on Mr. Hugh Reynold's farm " The Fort," in the Albany District, on a small krantzy outcrop facing south. In rosette and leaf shape it somewhat resembles *H. cymbiformis v. multifolia* Triebn., but the leaves are larger, not as numerous, not as pellucid and the rosettes are larger.

**Haworthia ramosa** G. G. Smith. Section Obtusatae.

*Planta* caulescens, rosetta diam. circiter 50 mm.

*Folia* plus minusve crebra, incurvata, longa usque ad 35 mm., lata 22 mm., obovata, abrupte acuminata ; *supra* basim versus plana, apicem versus concava, lineis 12 indistincte reticulatis percursa ; *subtus* convexa, lineis circiter 20 indistincte reticulatis percursa.

*Pedunculus* simplex, diam. 1½ mm., longus una cum racemo 18 cm. ; *pedicelli* longi 2 mm., diam. 1 mm. ; *bracteae steriles* 6—8 ; *bracteae* *fertiles* longae 4½ mm., deltoideae, acuminatae ; *perianthium* longum 15 mm., diam. basi 3½ mm., erecto-divergens ; *ovarium* longum 2½—3 mm., diam. 1¼ mm. ; *stylus* longus ¾ mm.

*Plant* caulescent, rosette 50 mm. diam. and high, the bare stem above ground about 5 cm. long, 7 mm. diam., the young plants developing from the axil of the lower leaves which after drying off leave a branched stem with many young plants, the branches about 4 cm. long by 5 mm. diam. and provided with many aerial roots, the stem and branches prostrate and decumbent, and with the many branched plant forming dense clusters.

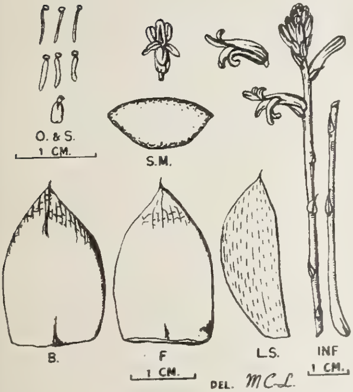


FIG. 7. H. lepida.

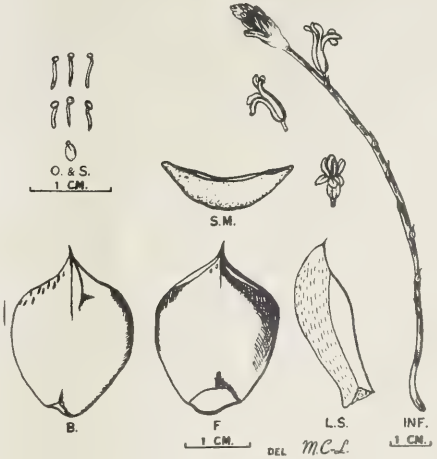


FIG. 8. H. ramosa.

*Leaves* somewhat crowded, incurved, the young erect, the older erect-spreading, somewhat tender, up to 35 mm. long, 22 mm. broad, 6 mm. thick near the tip, obovate, abruptly acuminate ; *end-awn* 1 mm. long, naked, reddish-pellucid ; *face* flat from the middle to base, concave to near tip, with a somewhat central raised concolorous line and about 12 somewhat indistinctly reticulate lines and a few pellucid oblong spots near the tip on some of the leaves, light green ; *back* rounded, with about 20 indistinctly reticulate lines and several narrow longitudinal long and short oblong pellucid spots near the tip, light green becoming reddish near tip ; *keel* central on most leaves, usually with a second one alongside, entire ; *margins* acute below and greenish-white, rounded and pellucid in the upper half, entire.

*Peduncle* simple, terete, fully 1½ mm. diam., 18 cm. long including the raceme, very light brown below ; *raceme* about 5 cm. long, about 15 flowers and buds, 1—3 open simultaneously ; *pedicels* 2 mm. long, 1 mm. diam., dark brownish-green ; *sterile bracts* 6—8, the lowest 2—3 cm. from the base of peduncle ; *fertile bracts* 4½ mm. long, deltoid acuminate, white, with a fine, very pale brown nerve ; *perianth* greyish-white, 15 mm. long, the 3½ mm. subglobose cylindrical-triangular base only slightly constricted above, oblong, erect-spreading, slightly curved ; *upper segments* obtuse, recurved, the face colour of the 2 outer ones white with a fine dark brown nerve, spreading, the inner one pink with a fine greenish-brown nerve ; *lower-segments* obtuse, recurved, face colour of the 2 outer pinkish-brown with a fine brown nerve, slightly replicate, spreading, the inner one channelled, the face colour pure white with a broad brown nerve ; *stamens* 4½—5 and 4—4½ mm. long ; *ovary* 2½—3 mm. long, slightly over 1¼ mm. diam., dull brownish-green ; *style* ¾ mm. long, bent, capitate, dull white.

*Habitat:* Cape Province: Peddie Division, near Wooldridge. (Type, *G. G. Smith* 3168, in East London Museum Herb.; co-types in Nat. Bot. Gdns. Herb., Kirstenbosch ; Nat. Herb., Pretoria.)

*Distribution :* not further known.

The name *ramosa* (branching) refers to the way in which this plant forms long branched stems, a character found in no other Haworthia in this section, so far recorded. Aerial roots are often found on several Haworthia species and varieties, principally in the Section Coarctatae, usually on the under-side of a prostrate plant, but branching rarely occurs except sometimes in a damaged plant. With *H. ramosa*, many aerial roots are developed on the upright and prostrate main stems or branches. This singular plant was discovered by Miss M. Courtenay-Latimer in March, 1940, near Wooldridge, in the Peddie District, where it grows in masses on a krantz facing south. This plant is near *H. cymbiformis* Haw. in the general appearance of the rosettes, but these are smaller in diameter and much longer.

# NOTES ON SCIRPUS AND DESCRIPTIONS OF THREE NEW SPECIES.

By

MARGARET R. LEVYNS.

Scirpus is well represented on the Cape Peninsula and recent work on the genus has shown that at least twenty-eight species occur within the area. A comparison of the list of species being drawn up at the present time with that of Bolus and Wolley-Dod published in 1904 reveals points of interest. Of the twenty-one species given there only fifteen remain unaltered in the new list. *S. bulbiferus* Boeck., *S. Isolepis* Boeck. and *S. Dregeanus* C.B.Cl. are omitted as the evidence for their inclusion is insufficient to justify their retention. The names of three species have been changed. Ten species have therefore been added to the flora of the Cape Peninsula, but of these only three are new. In the following account the new species are described and notes are given in explanation of the changes that are being made in the genus.

*Scirpus striatus* (Nees) Fourcade and **Scirpus rubicundus** (Nees) Levyns comb. nov.

Two species belonging to the subgenus Fluitantes have been imperfectly understood. One of these is fairly common, occurring both in shallow pools and along the margins of streams from sea level to the summit of Table Mountain. It appears to have a preference for acid soils. The other species is more restricted in its range and has only been recorded in temporary pools at low elevations. The soil on which it grows near Muizenberg vlei is very alkaline, with a PH. value between 8·5 and 9·0. This factor probably determines its distribution, as the writer has only found this species on soils of the same type. The first of these species was placed by Bolus and Wolley-Dod in *S. capillifolius* Parl. This name, however, is not the earliest one available, as Nees von Esenbeck described this species as *Eleogiton striatus* in 1836. The combination *S. striatus* has been made by Fourcade (Trans. Roy. Soc. S. Afr. XXI, p. 76, 1934). The reference there should read: "Nees in Linnaea X, p. 165, 1836," as no description of this species was published prior to this date. The other and less common species has puzzled many workers in the genus. C. B. Clarke named Wolley-Dod 3551 from Muizenberg *S. tenuissimus* Boeck., and it appeared under this name in Bolus and Wolley-Dod's list. It is clearly a misidentification. In 1922 Schönland (South African Cyperaceae. Bot. Surv. S. Afr. Memoir No. 3) placed it under *S. globiceps* C.B.Cl. There can be little doubt, however, that this plant was first described as *Eleogiton rubicundus* Nees (Linnaea X, p. 164, 1836). A new combination *S. rubicundus* is therefore proposed.

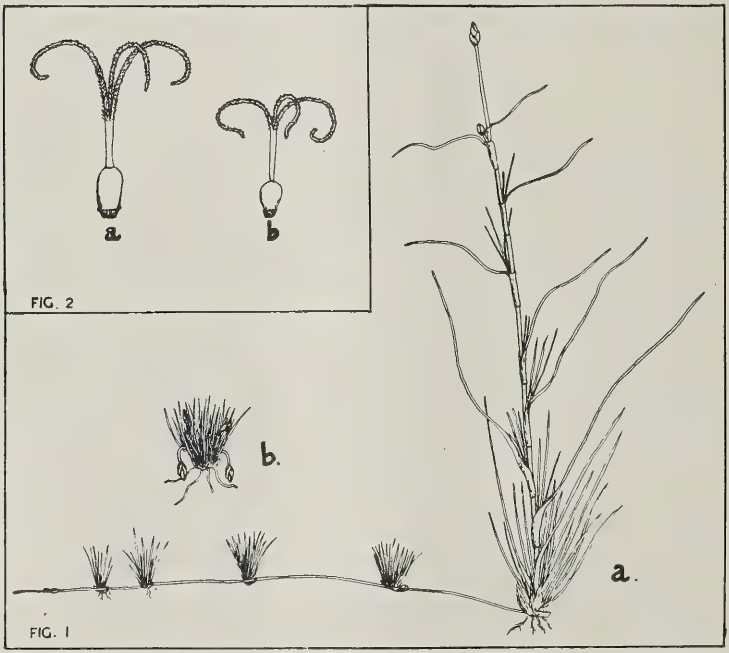


Fig. 1. *Scirpus rubicundus.* (*a*) Plant in August showing an erect shoot bearing spikelets and an old horizontal shoot bearing tufts of dead leaves. × $\frac{3}{4}$. (*b*) A small tuft early in July, showing spikelets. The peduncles of the older spikelets have turned downwards. × $\frac{3}{4}$.

Fig. 2. Gynaeceum showing the basal disc in (*a*) *S. Ecklonii* and (*b*) *S. nodosus.* × $7\frac{1}{2}$.

During their main flowering seasons these two species are not unlike in general aspect, though *S. rubicundus* usually has smaller spikelets, which are deep red in colour. *S. striatus* may or may not have this red coloration. The fruit, however, will always serve to separate the two. In both it is somewhat compressed, but viewed from the front *S. striatus* is oblong, occasionally slightly narrowed at the base, whereas a corresponding view of *S. rubicundus* shows the outline to be circular or nearly so. The surface of *S. striatus* is marked by a number of fine longitudinal lines. In *S. rubicundus* the surface is smooth.

Recently some interesting seasonal changes have been recorded in *S. rubicundus.* Early in June, 1924, Mr. M. H. Giffen collected a small tufted Scirpus growing in damp mud on the Cape Flats. A month later the writer found the same species on the Fish Hoek Flats. A striking peculiarity of this apparently new species was that it buried its solitary red spikelets in the mud during the fruiting stage. Specimens (Levyns 841) were sent to Kew, where it was regarded as a new species. Fortunately its description was never published, as it now appears that it is a seasonal form of *S. rubicundus.*

While studying the so-called new species a few months ago the writer realised that its spikelet was identical with that of *S. rubicundus* and re-examination of the original localities was clearly desirable. Unfortunately that at Fish Hoek has been completely altered by the establishment of a dairy farm. Mr. Giffen, however, remembered the exact spot on the Cape Flats where he had found his plants, and he and the writer visited the place in July, 1943, finding the natural vegetation much as it had been nineteen years earlier. Careful examination of the small tufts soon showed that they were connected in series by means of runners which were easily broken. A runner of this type is shown at the left of Fig. 1*a*. On tracing the runners back to their points of origin it was seen that the parent tufts had longer leaves and looked like *S. rubicundus.* Material was collected and brought in to the University of Cape Town, where it has been grown. At the present time (October) it is producing typical spikelets of *S. rubicundus*, such as are shown in Fig. 1*a*, and there can be no doubt that one species only is involved. In July of this year no evident spikelets were seen, but on dissecting the tufts ripening fruits were found among the leaf bases.

The annual cycle of this species can therefore be summarised as follows: Active growth in one of the larger tufts begins during the winter months while the plant is completely submerged in water. A long stem with well marked nodes and inter-nodes is put up, and at the end of this one or more fairly stout peduncles are produced, each ending in a solitary spikelet which projects above the surface of the pool. (Fig. 1*a*.) As the water in the pool begins to dry up axillary clusters of short leaves develop at each node, and by the time the pool is dry these branches, with their axillary tufts now completely developed, will be found sprawling on the surface of the mud. Roots develop at many of the nodes, so that during the summer months what had been a pool a few months earlier is bright green with the numerous short leaves on these interlacing branches. The majority of the small tufts last for one season only, but occasionally one grows more vigorously than its fellows and produces larger leaves. This has the power, also retained by the original tuft, of producing new branches during the next season. Soon after the winter rains have started, but before pools have been formed, the small tufts bear spikelets of the type shown in Fig. 1*b*. With the formation of fruit the life of these tufts is ended and next season only their dead remains will be found attached to the parent tuft.

*Scirpus antarcticus* L. and *Scirpus cartilagineus* (R. Br.) Poir.

In most South African collections of Scirpus two very distinct plants are included in *S. antarcticus* L. Both occur on the Cape Peninsula, one being very much more common than the other. The larger and the less common one is the plant to which Linnaeus gave the name *antarcticus.* This differs from the smaller plant in several features, leaving little doubt that they are distinct species and consequently another name must be found for the smaller. *S. cartilagineus* (R. Br.) Poir. is the earliest valid name. The differences between the two are tabulated below :

| *S. antarcticus.* | *S. cartilagineus.* |
|---|---|
| Plant about 20 cm. high. | Plant 10 cm. high or less. |
| Leaf sheaths rather loose. | Leaf sheaths firm. |
| Spikelets in a cluster, numerous, usually over 50. | Spikelets few in a cluster, rarely more than 8. |
| Fruit relatively smaller, faces always smooth. | Faces of the fruit usually covered with raised points or faint transverse lines, occasionally smooth. |

It is possible that more than one species is included in *S. cartilagineus.* Like most widespread and abundant species it is extremely polymorphic and it would be rash to create several new species without careful study. Work on this problem is in progress.

**Scirpus Thunbergianus** (Nees) Levyns comb. nov.

C. B. Clarke (Flora Capensis, Vol. VII, p. 227) described this plant as *S. Holoschoenus* L. var. *Thunbergii* C.B. Cl. It differs from the Linnaean species in the characters given below and it is clear that the differences are far too great for mere varietal status. The leaf blade is completely absent or reduced to a small point, the peduncles are flattened, the bracts subtending the inflorescence are small (i.e. they are shorter than the majority of the stalked clusters of spikelets), and the lowest does not form an apparent continuation of the peduncle. The fertile bracts are entirely glabrous and have a fairly wide papery margin in the upper half, while the midrib projects as a small point.

This plant cannot be raised to specific rank under the name *S. Thunbergii* (Schrad.) Boeck. as the epithet *Thunbergii* was given to another plant by A. Sprengel in 1828. Nees von Esenbeck regarded it as a distinct species under the name *Isolepis Thunbergiana* (Linnaea VII, p. 508, 1832), and the new combination *S. Thunbergianus* is now proposed.

**Scirpus chlorostachyus,** Levyns nom. nov.

C. B. Clarke regarded this plant as a variety of *S. cernuus* Vahl (Flora Capensis, Vol. VII., p. 220). It seems, however, to merit specific rank and as none of the existing epithets which have been applied to it can be used legitimately in its new rank, the name *S. chlorostachyus* is adopted.

**Scirpus nanodes,** Levyns nom. nov.

This plant has hitherto been known as *S. tenuis* Spreng. Unfortunately Willdenow had already used the epithet for a different species (Enum. Hort. Berol. p. 76) and as none of the other epithets applied to this plant in the past can be used legitimately in Scirpus a new one has to be found.

*S. digitatus* (Schrad.) Boeck.

This species is usually cited as *S. flaccifolius* Steud. but the name *digitatus* has priority.

*Scirpus Ecklonii* Steud.

Scirpus and Ficinia are separated from one another largely by the presence of a lobed disc at the base of the ovary in the latter. The disc enlarges as the fruit ripens and falls with it. The two genera are obviously very closely related and the correct assignment of certain species raises very real difficulties. A case in point is the plant called by Nees von Esenbeck *Ficinia Ecklonea* and by Steudel *Scirpus Eckloneus*. This plant has a small disc at the base of the ovary (Fig. 2a) but this structure does not persist in the fruit, shrivelling up as development proceeds. In the writer's opinion it is desirable to follow Steudel here, for despite the small disc the other characters indicate relationship between this species, *S. membranaceus* Thunb. and *S. nodosus* Rottb. In *S. membranaceus* no trace of a disc is to be seen but in *S. nodosus* there is often a disc quite as obvious as that of *S. Ecklonii* (Fig. 2b). All taxonomists know that reliance on one character alone for purposes of classification is apt to be misleading, and this is particularly true of these two Cyperaceous genera.

*Scirpus nodosus* Rottb.

In this species plants are of two kinds, (*a*) those with normal bisexual flowers and (*b*) those with female flowers only. Abortive anthers are present in the female flowers. Both types of plant occur growing together in several places on the Cape Peninsula where the species is common.

## NEW SPECIES.

**Scirpus delicatulus,** Levyns sp. nov. (Fig. 3).

Herba perennis. *Caulis* repens, debilis, internodis elongatis. *Folia* capillaria. *Spicula* angusta, solitaria, terminalia. *Bracteae* scariosae, obtusae. *Stamina* 3. *Rami styli* 3. *Nux* triquetra, levis.

A submerged water plant. Stem weak and creeping, rooting at the nodes, producing a few very slender leaves and peduncles at each node. Leaves capillary, channelled, up to 18 cm. long, usually shorter than the peduncles. Peduncles a little stouter than the leaves, each bearing a single, terminal spikelet. Spikelet narrowly ellipsoidal, 6 mm. long or less, consisting of few to several bracts, frequently all fertile or the lowest one or two sterile. Bracts thin, concave, obtuse, greenish in the centre, with a reddish, translucent margin. Stamens 3. Style branches 3. No completely ripe fruit seen. In the ripest available the fruit was three angled but not acutely so and the faces were smooth and dull yellow-brown in colour.

*Hab.* Cape Peninsula : *Levyns* 6345. Kenilworth Racecourse. (*Type*, in the Bolus Herbarium.) This species has also been collected at Fish Hoek ; *Levyns* 837.

**Scirpus inconspicuus** Levyns sp. nov. (Fig. 4).

Herba annua, minuta, simplex. *Folia* gracilia. *Spicula* solitaria, terminalia. *Bracteae* 2 vel 3, foliaceae. *Stamina* 3. *Antherae* breves. *Stylus* brevissimus, ramis 3. *Nux* tenuis, elongata, subtriquetra.

A minute annual, 2—3 cm. high. Leaves slender, equalling or shorter than the inflorescence, sheaths red, firm. Spikelets narrow, solitary, terminal, bearing 1—3 flowers, all the bracts usually fertile. Bracts reddish at the base, with a free leaf-like tip. Stamens 3, anthers very much shorter than the filament at maturity. Style branches 3, free almost to the base. Fruit long and slender, faintly three angled, pale brown.

*Hab.* Cape Peninsula: *Levyns* 6777. (*Type*, in the Bolus Herbarium.) Muddy places on Paarden Island, forming a turf along tidal channels.

Flowering season : Aug.—Sept.

**Scirpus brevicaulis** Levyns sp. nov. (Fig. 5.)

Herba annua, caespitosa, minuta. *Folia* quam spicula subsessilia longiora. *Spicula* numerosa, conferta. *Bracteae* foliaceae, numerosae. *Stamina* 2 vel rarius 3. *Stylus* brevissimus, ramis 2. *Nux* complanata, punctata.

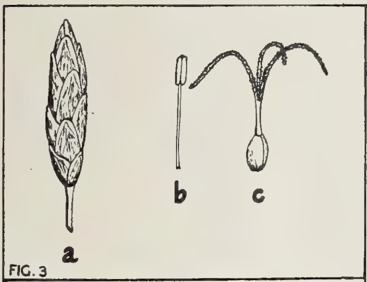


FIG. 3

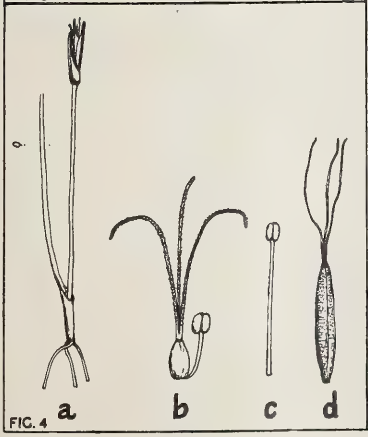


FIG. 4

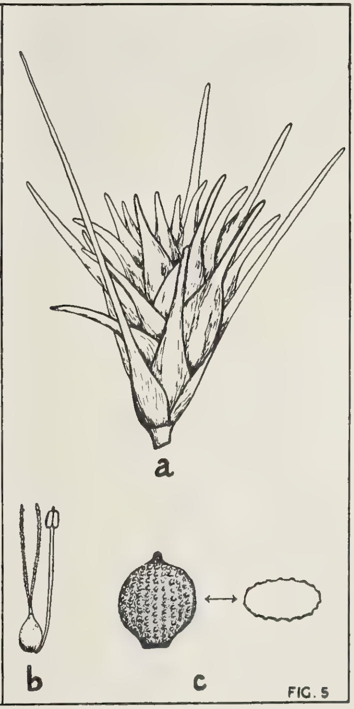


FIG. 5

FIG. 3. *Scirpus delicatulus.* (*a*) External view of the spikelet. × 5. (*b*) A single stamen at the time of dehsicence. × 6. (*c*) Gynaeceum. × 6.

FIG. 4. *S. inconspicuus.* (*a*) Whole plant. × 2. (*b*) Gynaeceum and young stamen. × 9. (*c*) Stamen at the time of dehiscence. × 9. (*d*) Fruit, nearly ripe. × 9.

FIG. 5. *S. brevicaulis.* (*a*) External view of a spikelet. × 5. (*b*) Gynaeceum and a single stamen at the time of dehiscence. × 10. (*c*) Fruit seen from the front; the outline of a cross section is shown next to it. × 20.

A minute, densely tufted annual, 2 cm. high or less. Leaves basal, few to several, exceeding the spikelets. Spikelets densely clustered at ground level, easily overlooked owing to the leaf-like appearance of the bracts. All bracts usually fertile, sheathing and hyaline at the base, produced above into long, green leaf-like tips which diminish in length from without inwards. Stamens usually 2, occasionally 3 in flowers at the base of the spikelet, anthers small at the time of dehiscence, much shorter than the filament. Style very short, with 2 long branches. Fruit dorsally compressed, pale brown, the surface somewhat rough with minute raised lumps in longitudinal rows.

*Hab.* Cape Peninsula : *Levyns* 7576. Ironstone gravel on flats between Maitland and Pinelands. (*Type*, in the Bolus Herbarium.)

Flowering season. Aug.—Sept.

This species is allied to *S. Hystrix* Thunb. from which it differs in the absence of visible peduncles, the much longer green tips of the bracts, the 2 style branches and the biconvex fruit.

# ALLENIA, NEW GENUS.

By

E. P. PHILLIPS.

**Allenia** Phillips gen. nov. ab *Hibiscus* Linn. stylo capitato differt.

*Bracteolae* 12, lineares, basi connatae. *Tubus calyci* campanulatus, villosus ; lobi ovati. *Petala* oblonga, basi columna staminea adnata. *Columna staminea* supra filamenta ∝ exserens. *Ovarium* 5-loculare, loculis 3—4-ovulatis ; stylus apice capitatus. *Capsula* 5-valvata. *Semina* glabra.

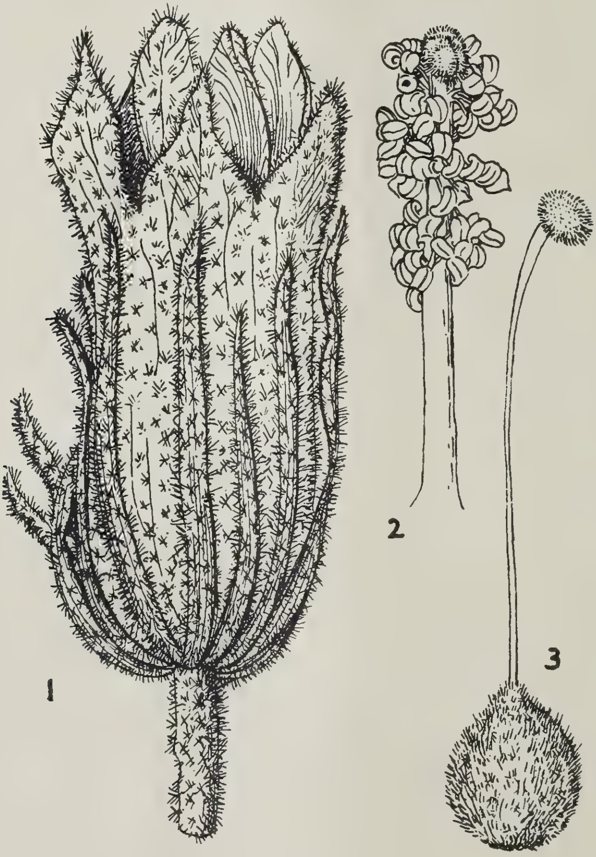
Herba procumbens, villosa ; folia petiolata, ovata, basi cordata ; flores axillares, 2—4-nati.

Type : *A. urens* (Linn. f.) Phill. = *Hibiscus urens* Linn. f.

**Allenia urens** (Linn. f.) Phill. *Epicalyx* of 12 linear tomentose lobes connate at the base to form a shallow basin ; lobes 2 cm. long, veined. *Calyx-tube* campanulate, 2 cm. long, 1·8 cm. diameter above, densely tomentose ; lobes shorter than the tube, ovate. *Petals* 2–4 cm. long, 8 mm. broad, oblong, obtuse, veined, adnate at the base to the staminal-column, tomentose without. *Staminal-column* 2 cm. long, broadened at the base, bearing many anthers on free filaments on the upper half ; filaments terete, slightly shorter than the anthers ; anthers reddish, horse-shoe shaped after dehiscence, 2-thecous. *Ovary* sub-globose, deeply 5-lobed, 5-chambered, with several axile ovules in each chamber, densely tomentose ; style terete, as long as the staminal-column ; stigma capitate, divided into 5 fleshy cushions which are pubescent. *Fruit* a 5-valved capsule. *Seed* glabrous ; embryo straight ; cotyledons flat, elliptic ; endosperm copious.

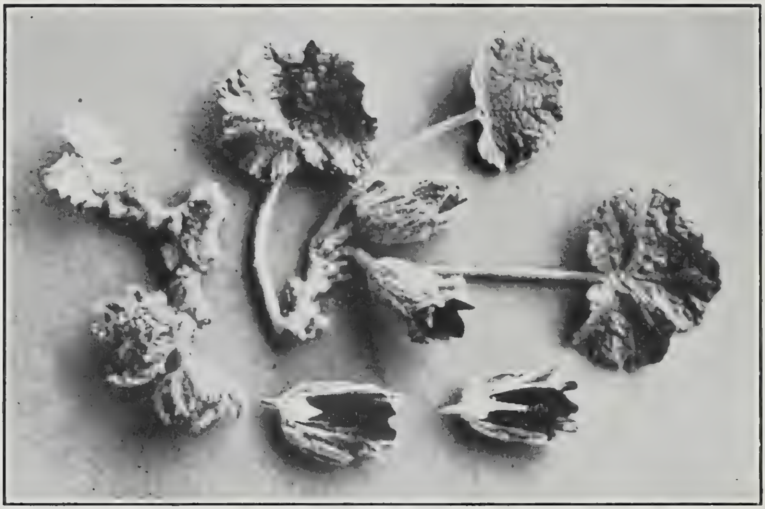
A procumbent herb with the stems radiating and up to 1·2 m. long and with the leaves and flowers vertical, the whole plant densely stellately tomentose with stinging hairs ; leaves petioled ; lamina 2·5—9·5 cm. long, 2·5—12 cm. broad, ovate or sub-orbicular, cordate at the base, prominently veined beneath, rugose above ; petiole 4—12 cm. long ; flowers a deep claret-red, large, axillary, 2—4-nate.

The species is apparently confined to the dry semi-Karoo area roughly bounded by the Bloemhof district in the north, through Fauresmith and the Luckhoff district to Graaff-Reinet and then westwards through de Aar, Williston, Namaqualand and Bushmanland to South-West Africa.



*Allenia urens.* 1. Single flower. 2. Staminal-column with anthers and apex of style projecting. 3. Gynaecium (note the globose capitate stigma.)

The plant is commonly known as the " wilde pampoen " or " wild pumpkin " and it is interesting to note that Burchell named it *Hibiscus ucurbitinus.* When dry it has a disagreeable odour.



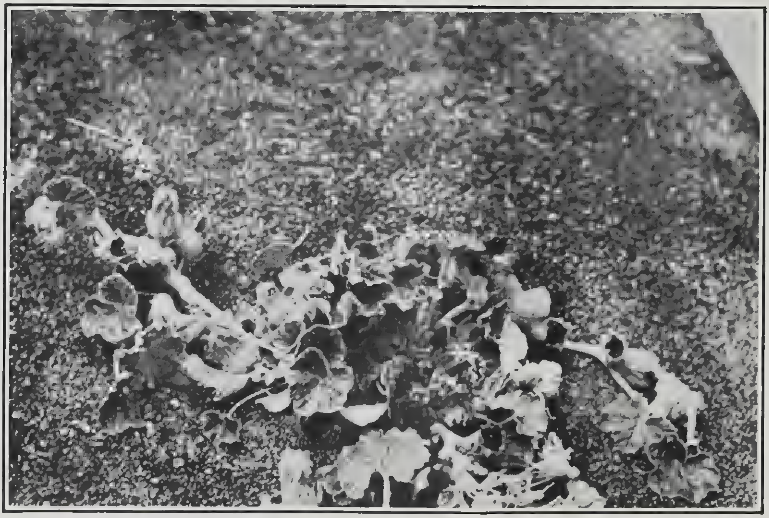


PLATE III. *Allenia urens.* (*Above*) Portions of plant, showing the binate flowers. (*Below*) Wild plant, showing habit. Photographs by J. A. van Zijl, October, 1943.

An examination of the genus *Hibiscus* which the writer undertook in connection with a revision of "The Genera of South African Plants" convinced him that the plant named *Hibiscus urens* Linn. f. differed from the other South African species of *Hibiscus* and that it could not be retained in that genus. Dr. M. Henrici and Miss I. C. Verdoorn recently collected some excellent spirit material while on a collecting trip in the Luckhoff district which supplemented the herbarium specimens. The main characters which separate the plant from *Hibiscus* are the capitate stigma and the location of the anthers on the upper portion of the staminal-column. The genus is named in honour of Dr. Robert Allen Dyer of the Division of Botany and Plant Pathology, author of many botanical publications and co-author of "The Succulent Euphorbieae."

JOURNAL
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# ROOT RESERVES OF SOUTH AFRICAN HIGHVELD GRASSES IN RELATION TO FERTILIZING AND FREQUENCY OF CLIPPING.

By H. Weinmann.

## INTRODUCTION.

The influence of cutting treatments on herbage growth and root development of grasses has been studied by many workers in various countries. Earlier literature on this subject has been reviewed by Graber (3), Robertson (15), and Biswell and Weaver (2). The latter report that "investigators are in agreement that the more frequent and drastic the cutting treatment the less is the yield of tops, rhizomes and roots."

Experimenting with six North American prairie grasses Biswell and Weaver (2) found that the root weight of plants clipped four to seven times at fortnightly intervals averaged only ten per cent. of that of unclipped control plants; the species investigated were *Andropogon furcatus*, *Bulbilis dactyloides*, *Panicum virgatum*, *Poa pratensis*, *Andropogon scoparius*, *Bouteloua gracilis* and *Bouteloua curtipendula*. Robertson (15) studied the response of six range and pasture grasses, viz. *Poa pratensis*, *Bouteloua gracilis*, *Koeleria cristata*, *Stipa spartea*, *Bromus inermis* and *Holcus sorghum sudanensis*. Four clippings reduced root growth in these species about twice as much as that of tops; the roots of the clipped plants ranged in weight from one-third to one-fiftieth as much as those of their controls. Similar results were obtained by Graber (3) with *Poa pratensis*, *Agrostis alba* and *Phleum pratense*. In *Phalaris tuberosa* (13) cutting five times reduced the yield of herbage by 54 per cent., and the root system by 78 per cent. Sturkie (18) found that the root stock development of *Sorghum halepense* was reduced by any cutting treatment and that the degree of reduction increased with the frequency of cutting. According to Hase (7) clipping decreased length and spread of the roots of *Buchloe dactyloides*, *Bouteloua gracilis* and *Bouteloua curtipendula*.

A number of workers have also demonstrated that the reduction in root and rhizome weight will be the greater the shorter the grass is cut. According to Stapledon and Milton (17) the root weight of *Dactylis glomerata* plants cut every three weeks to ground level was only about one third of that of plants clipped every three weeks to a height of six inches. In experiments carried out by Graber and Ream (4) *Poa pratensis* invariably formed less roots and rhizomes when cut to a height of ½ inch than when cut to a height of 1½ inches. In *Festuca rubra, Poa pratensis* and *Agrostis capillaris* Harrison (5) found that " the shorter the grass was cut and the more leaf area was reduced, the smaller was the quantity of roots produced." The same response was shown by various *Agrostis* species and *Festuca duriuscula* (16), *Phleum pratense* and *Lolium perenne* (14), *Lolium italicum* and *Festuca pratensis* (19).

The results of certain investigations indicate the existence of interactions between clipping and other factors affecting growth, particularly nitrogen supply. Graber and Ream (4) concluded from their work on *Poa pratensis* that only when a productive level of reserves was maintained by height or infrequency of cutting did the plants utilise an abundance of nitrogen to produce abundant vegetative growth. Harrison (5) found that application of mineral fertilizers did not compensate for a lack of top growth in the production of roots in the grasses investigated ; on the contrary, addition of ammonium sulphate to closely clipped plants of *Festuca rubra* and *Poa pratensis* resulted in a further decrease in their root weight, whilst plants of *Agrostis capillaris* were even killed by this treatment. Growing *Poa pratensis* under controlled conditions in the greenhouse, Harrison (6) was later able to confirm that the addition of nitrogen tends to aggravate the deleterious effects of frequent clipping on the root system. Plants supplied with nitrogen died after fourteen clippings at weekly intervals, whilst plants without additional nitrogen supply survived the same cutting treatment. Abundant nitrogen supply, particularly when combined with optimal temperatures, led to rapid vegetative regeneration resulting in a reduction of the weight of roots and rhizomes, presumably due to excessive mobilisation and exhaustion of carbohydrate reserves. Similarly, Johnson and Dexter (8) found that frequent and short cutting was very injurious to plants of *Agropyron repens* receiving an abundant supply of nitrogen, but caused only slight injury to " minus-nitrogen " plants. The authors consider that the stimulation of vegetative growth by nitrogen under conditions of frequent and close cutting resulted in a depletion of organic reserves stored up in roots and rhizomes, eventually leading to carbohydrate starvation and death.

That excessive defoliation results in a depletion of organic food reserves in the underground parts is indicated by the results of chemical analyses carried out by several workers. Aldous (1) showed that in composite root samples of prairie grasses the percentages of total sugars, starch and dextrin decreased with the frequency of cutting, " the greatest amounts being present in the roots of plants that had not been cut or that had been cut less frequently and at the greatest heights." According to McCarty (9) one clipping carried out at different times of the season lowered in almost every case the percentage of sugars and starch present in stem bases and roots of *Elymus ambiguus* at the end of the season. In a later investigation the same author (10) demonstrated that three clippings at five-day intervals during spring removed one third of the amounts of sugars and starch stored up in the stem bases and roots of *Bromus carinatus.* In a further contribution McCarty and Price (11) report that the amounts of reserve carbohydrates (mainly sucrose and starch) in stem bases and roots of *Bromus carinatus* and *Agropyron tenerum* were lowered by all the clipping treatments employed ; the degree of reduction depended on the time, frequency and closeness of cutting. The level of root reserves was lowest in plants continuously clipped short. In *Agropyron spicatum* (12) clipping to crown level at two-weeks intervals during eight weeks of the vegetative stage reduced the proportion of storage carbohydrates by fifty per cent. as compared with unclipped control plants.

In a recent investigation the writer (22) subjected South African Highveld grassland vegetation to a series of clipping treatments for two years. It was found that root weights as well as percentages of sugars and starch in the roots decreased progressively with the frequency of clipping. Cutting at monthly intervals reduced the total dry matter of the roots on an average by 63 ·8 per cent. and the combined amounts of sugars and starch by 76 ·6 per cent. as compared with one clipping per year. Fertilizer treatment was not able to counteract the damage to root development and the exhaustion of root reserves brought about by frequent defoliation.

The present contribution reports the results of an experiment designed to test the effects of various frequencies of cutting, with and without fertilizer treatment, on root development and carbohydrate reserves of five important South African Highveld grasses.

## EXPERIMENTAL METHODS.

The experiment was conducted at Frankenwald, the Botanical Research Station of the University of the Witwatersrand, near Johannesburg. On a piece of undisturbed veld, which had been subjected to uncontrolled light grazing for some years, six plots were laid out in winter 1939, after old growth had been removed by burning.

The soil of the area is an acid loamy sand of about twelve inches depth on decomposed granite. The soil is poor in organic matter, nitrogen and phosphorus ; the pH is 5·4. The results of an analysis of the surface soil are given in Table I.

TABLE I.

RESULTS OF SOIL ANALYSIS.

*Percentages of Dry Fine Earth.*

| | | | |
|---|---|---|---|
| Sand | 75·2 | Loss on Ignition | 3·9 |
| Silt | 13·0 | Nitrogen | 0·086 |
| Clay | 11·8 | Phosphoric Oxide | 0·016 |
| Total Colloids | 13·4 | Potash | 0·063 |
| Maximum Water Retaining Capacity | 42·4 | | |

Three of the above-mentioned six plots were not fertilized (O), whilst the other three plots received a well-balanced fertilizer treatment (NPK) during the two seasons 1939-40 and 1940-41. The amounts of fertilizer applied per morgen during each season were :—

800 lbs. of Kynoch Grass No. 1, equivalent to 120 lbs. $P_2O_5$, 40 lbs. N and 40 lbs. $K_2O$. This fertilizer was spread each year in spring. In addition, two dressings of 200 lbs. of ammonium sulphate per morgen (= 42 lbs. N per dressing) were applied at convenient intervals during the season.

The rainfall amounted to 32·3 inches in 1939-40 and to 35·8 inches in 1940-41.

Five quadrats, each two square metres in extent, were pegged out in each of the six plots. During both seasons these quadrats were subjected to different clipping treatments, as follows :—

*Number of Clippings per Season.*

Quadrat No. 1 : One (in the beginning of April).
Quadrat No. 2 : Two (in the middle of December and April).
Quadrat No. 3 : Four (at two-monthly intervals, namely in November, January, March and May).
Quadrat No. 4 : Nine (at monthly intervals from September to May).
Quadrat No. 5 : Sixteen (at approximately fortnightly intervals during the months of September to May).

Clipping was carried out with sickles and scissors, the herbage being removed as completely as possible. The clipped herbage was collected, dried, weighed and chemically analysed. These herbage data have been published elsewhere (23), and will be discussed here only as far as they have a bearing on the results reported in this paper.

At the end of the period of treatment root samples were taken of the five dominant grass species in the area, namely *Trachypogon plumosus*, *Tristachya hispida*, *Eragrostis chalcantha*, *Brachiaria serrata* and *Digitaria tricholaenoides*. The first four of these grasses are typical tufted grasses, whilst *Digitaria tricholaenoides* forms irregular mats by means of rhizomes. In order to obtain comparable data of root weights it was decided to base root weights on basal area in the case of the four tufted grasses. For this purpose, the outlines of a number of tufts of each species were traced at the beginning of the experiment on celloidin paper mounted on a sheet of glass. Generally, a total of twelve or more tufts per species and treatment, distributed over the three quadrats of the same treatment, were traced in this way. At the same time the exact position of every traced tuft was entered on a map for each quadrat so that the plants could be found again for subsequent collecting of the roots. The traced tuft areas were also measured by planimeter. In the winter of 1941, after the clipping and fertilizer treatments had been continued for two seasons, the roots of the marked plants were dug out to a depth of four inches. The individual root samples of the same species and treatment were combined to form one sample and, since the total basal area was known, the root weight of one square decimetre basal area could be calculated.

This procedure was not possible with *Digitaria tricholaenoides*. Here, relatively big samples were taken of both roots and rhizomes from the upper four inches of the soil. After the material had been killed and dried (see below), the roots were separated from the rhizomes and both were weighed. By measuring the total length of the rhizomes of each sample or of a weighed aliquot thereof, the weight of one metre rhizome length and the root weight per metre rhizome length could be calculated. Thus, whilst the figures for the weights of the *Digitaria* roots cannot directly be compared with those of the other grasses, they are at least comparable with one another.

All root and rhizome samples were—as far as possible—freed from adhering soil, killed by autoclaving for five minutes at five lbs. pressure, dried at a temperature of about 60°C, weighed and ground for chemical analysis. Reducing and non-reducing sugars, starch (including dextrin) and acid-hydrolysable polysaccharides were determined, using essentially the same methods as previously employed by the writer (22). In order to eliminate errors due to adhering soil all chemical constituents were expressed as percentages of combustible dry matter ; root and rhizome weights were likewise calculated as combustible dry matter.

## DISCUSSION OF RESULTS.

*Root and Rhizome Weights.*—The root and rhizome weights are shown in Table II and Fig. 1. All root weights decreased with increased frequency of clipping. The root weights of plants clipped twice a year were in some cases higher than those of plants cut once a season, in other cases they were equal or not appreciably lower. Very significant reductions in the root weights were, however, brought about when the herbage was cut four times per season or more often. In the case of *Eragrostis chalcantha* plants cut sixteen times a year only traces of roots were found.

TABLE II.

ROOT AND RHIZOME WEIGHTS.

ROOT WEIGHTS IN GRAMS OF COMBUSTIBLE DRY MATTER PER ONE SQUARE DECIMETRE BASAL AREA.

| Number of cuts per season. | | 1 | 2 | 4 | 9 | 16 |
|---|---|---|---|---|---|---|
| Trachypogon pl. .. | O | 4·78 | 5·37 | 2·80 | 0·85 | 0·66 |
| | NPK | 6·73 | 5·62 | 3·00 | 0·63 | 0·42 |
| Tristachya hisp. .. | O | 4·92 | 6·50 | 3·85 | 2·54 | 2·26 |
| | NPK | 7·62 | 9·60 | 7·33 | 1·85 | 1·21 |
| Eragrostis chalc. .. | O | 3·64 | 3·66 | 2·42 | 0·28 | 0·02 |
| | NPK | 7·38 | 9·90 | 2·45 | 0·27 | 0·04 |
| Brachiaria serr. .. | O | 10·20 | 15·33 | 1·68 | 0·63 | 2·16 |
| | NPK | 12·32 | 11·23 | 1·53 | 1·09 | 1·01 |

ROOT AND RHIZOME WEIGHTS OF *Digitaria tricholaenoides* IN GRAMS OF COMBUSTIBLE DRY MATTER PER ONE METRE RHIZOME LENGTH.

| Number of cuts per season. | | 1 | 2 | 4 | 9 | 16 |
|---|---|---|---|---|---|---|
| Roots .. .. .. | O | 0·61 | 0·59 | 0·48 | 0·27 | 0·18 |
| | NPK | 1·57 | 1·63 | 0·99 | 0·26 | 0·09 |
| Rhizomes .. .. | O | 10·78 | 10·71 | 10·77 | 7·90 | 8·14 |
| | NPK | 13·54 | 13·23 | 7·90 | 6·82 | 6·28 |

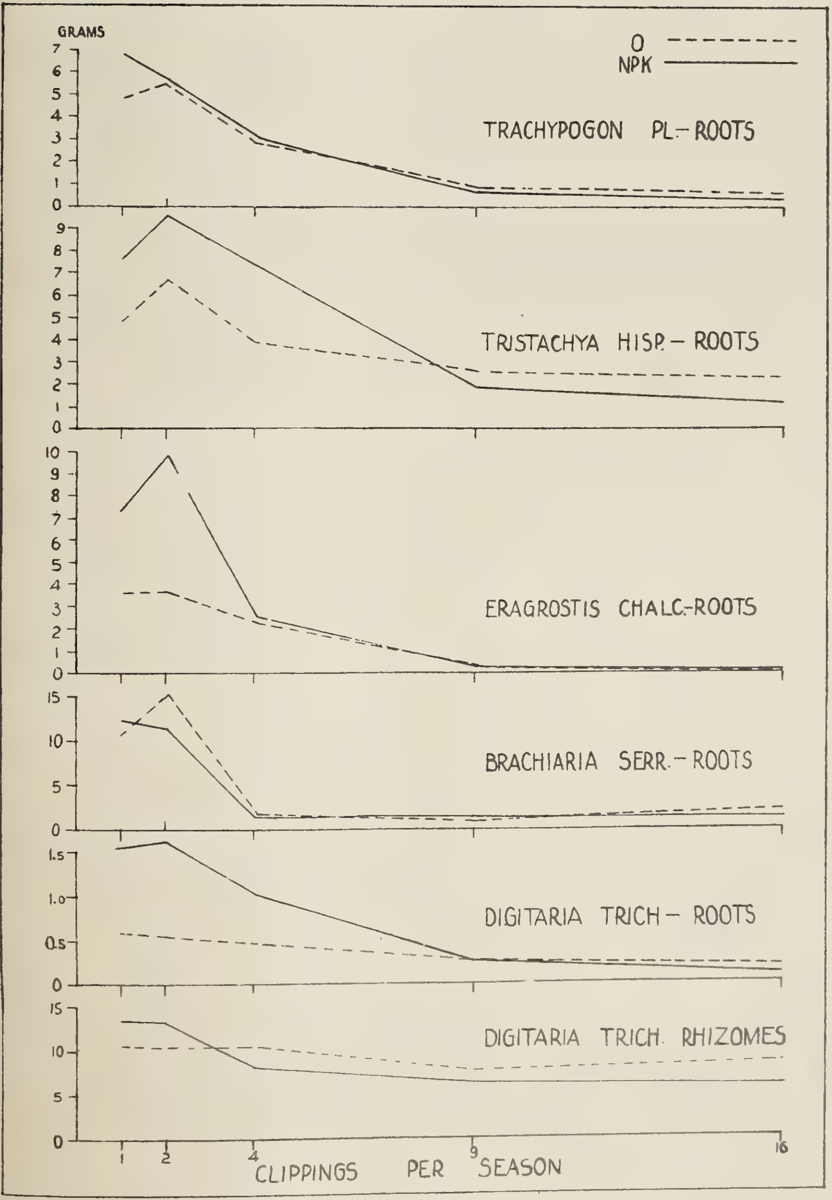

Fig. 1. Root and rhizome weights in relation to clipping frequency.

The weights of the rhizomes of *Digitaria tricholaenoides* suffered relatively slight reduction due to increased intensity of defoliation ; the differences would, however, not include any possible decrease due to reduction of total rhizome length. Whilst fertilizer treatment seems to have increased the root weights of *Tristachya hispida*, *Eragrostis chalcantha* and *Digitaria tricholaenoides*, at least under conditions of moderate defoliation, the differences due to fertilizer treatment are mostly insignificant with the roots of *Trachypogon plumosus* and *Brachiaria serrata*, and the rhizomes of *Digitaria tricholaenoides*. The effect of fertilizer treatment was, thus, not very consistent in the various species studied, though fertilizer treatment considerably increased the total herbage yields (23). With excessive defoliation, application of fertilizer tended to reduce the root weights, which would agree with the findings of other workers previously mentioned (5, 6, 8). In an earlier investigation, where the root bulk from whole quadrats was determined, the writer (22) could detect no effects of fertilizers on root growth, and it was concluded " that measurable effects of fertilizers on root development should not necessarily be expected in every case where the same treatments significantly influence the herbage yield."

Since many grasses send some of their roots down to a considerable depth, and roots were collected only to a depth of four inches, it may be argued that the reported root weights are not reliable. In 1941, however, two unclipped quadrats, each one square metre in extent, were dug up in the experimental area, and the total weight of roots determined in four-inch layers to a depth of twenty inches. The results are shown in Table III.

TABLE III.

ROOT WEIGHTS IN DIFFERENT SOIL LAYERS.

| Soil layer. | Grams air-dry Root Weight. | Percentage of total Root Weight collected (0-20 ″). |
|---|---|---|
| 0— 4″ | 613 | 67·7 |
| 4— 8″ | 107 | 11·8 |
| 8—12″ | 103 | 11·4 |
| 12—16″ | 59 | 6·5 |
| 16—20″ | 24 | 2·6 |
| Total | 906 | 100·0 |

The results indicate that the largest proportion (about 2/3) of the roots of these grasses occurs in the upper four inches of the soil, and that the root bulk rapidly decreases in lower soil levels. Hence, the root

## TABLE IV.

## SUGAR AND STARCH CONTENT OF ROOTS AND RHIZOMES.

EXPRESSED AS PERCENTAGES OF COMBUSTIBLE DRY MATTER.

| Number of cuts per year. | Unfertilized. | | | | Fertilized. | | | |
|---|---|---|---|---|---|---|---|---|
| | Reducing Sugars | Non-reducing Sugars | Starch | Total | Reducing Sugars | Non-reducing Sugars | Starch | Total |
| *Trachypogon plumosus : Roots.* | | | | | | | | |
| 1 .. .. | 0·67 | 6·05 | 1·59 | 8·31 | 0·67 | 7·25 | 1·52 | 9·44 |
| 2 .. .. | 0·53 | 5·07 | 1·05 | 6·65 | 0·85 | 6·35 | 1·59 | 8·79 |
| 4 .. .. | 0·48 | 3·16 | 0·94 | 4·58 | 0·62 | 3·82 | 2·89 | 7·33 |
| 9 .. .. | 0·48 | 0·41 | 0·83 | 1·72 | 0·57 | 3·23 | 0·61 | 4·41 |
| 16 .. .. | 0·65 | 0·56 | 0·87 | 2·08 | 0·00 | 0·93 | 0·47 | 1·40 |
| *Tristachya hispida : Roots.* | | | | | | | | |
| 1 .. .. | 0·60 | 2·89 | 8·53 | 12·02 | 0·61 | 3·50 | 6·62 | 10·73 |
| 2 .. .. | 0·69 | 2·81 | 6·88 | 10·38 | 0·63 | 3·06 | 6·85 | 10·54 |
| 4 .. .. | 0·74 | 2·31 | 5·00 | 8·05 | 0·85 | 2·67 | 5·10 | 8·62 |
| 9 .. .. | 0·29 | 0·55 | 0·66 | 1·50 | 0·29 | 0·55 | 0·56 | 1·40 |
| 16 .. .. | 0·16 | 0·08 | 0·64 | 0·88 | 0·33 | 0·14 | 0·73 | 1·20 |
| *Eragrostis chalcantha : Roots.* | | | | | | | | |
| 1 .. .. | 0·48 | 3·51 | 1·38 | 5·37 | 0·43 | 4·66 | 1·16 | 6·25 |
| 2 .. .. | 0·48 | 3·34 | 0·41 | 4·23 | 0·51 | 3·45 | 0·51 | 4·47 |
| 4 .. .. | 0·27 | 3·05 | 0·39 | 3·71 | 0·37 | 2·61 | 0·28 | 3·26 |
| 9 .. .. | 1·00 | 2·50 | 0·56 | 4·06 | 0·47 | 3·97 | 0·18 | 4·62 |
| *Brachiaria serrata : Roots.* | | | | | | | | |
| 1 .. .. | 0·67 | 5·07 | 1·91 | 7·65 | 0·71 | 4·31 | 2·81 | 7·83 |
| 2 .. .. | 0·49 | 5·41 | 0·88 | 6·78 | 0·52 | 3·53 | 0·20 | 4·25 |
| 4 .. .. | 0·53 | 2·14 | 0·60 | 3·27 | 0·08 | 1·79 | 0·46 | 2·33 |
| 9 .. .. | 0·19 | 2·66 | 0·32 | 3·17 | 0·00 | 2·11 | 0·87 | 2·98 |
| 16 .. .. | 0·32 | 0·29 | 0·54 | 1·15 | 0·87 | 0·66 | 0·56 | 2·09 |
| *Digitaria tricholaenoides : Roots.* | | | | | | | | |
| 1 .. .. | 1·02 | 4·30 | 0·85 | 6·17 | 1·11 | 7·73 | 0·51 | 9·35 |
| 2 .. .. | 0·79 | 4·30 | 0·74 | 5·83 | 1·18 | 4·44 | 0·56 | 6·18 |
| 4 .. .. | 0·74 | 3·85 | 0·58 | 5·17 | 0·80 | 5·85 | 0·49 | 7·14 |
| 9 .. .. | 0·36 | 0·74 | 0·80 | 1·90 | 0·06 | 0·73 | 0·43 | 1·22 |
| 16 .. .. | 0·46 | 1·01 | 0·70 | 2·17 | 0·00 | 0·36 | 0·65 | 1·01 |
| *Digitaria tricholaenoides : Rhizomes.* | | | | | | | | |
| 1 .. .. | 0·42 | 1·00 | 1·55 | 2·97 | 0·46 | 1·16 | 0·79 | 2·41 |
| 2 .. .. | 0·38 | 0·56 | 1·30 | 2·24 | 0·64 | 1·36 | 0·91 | 2·91 |
| 4 .. .. | 0·39 | 0·58 | 1·75 | 2·72 | 0·62 | 1·86 | 0·83 | 3·31 |
| 9 .. .. | 0·28 | 0·18 | 0·91 | 1·37 | 0·15 | 0·18 | 0·61 | 0·94 |
| 16 .. .. | 0·29 | 0·01 | 1·37 | 1·67 | 0·30 | 0·30 | 0·84 | 1·44 |

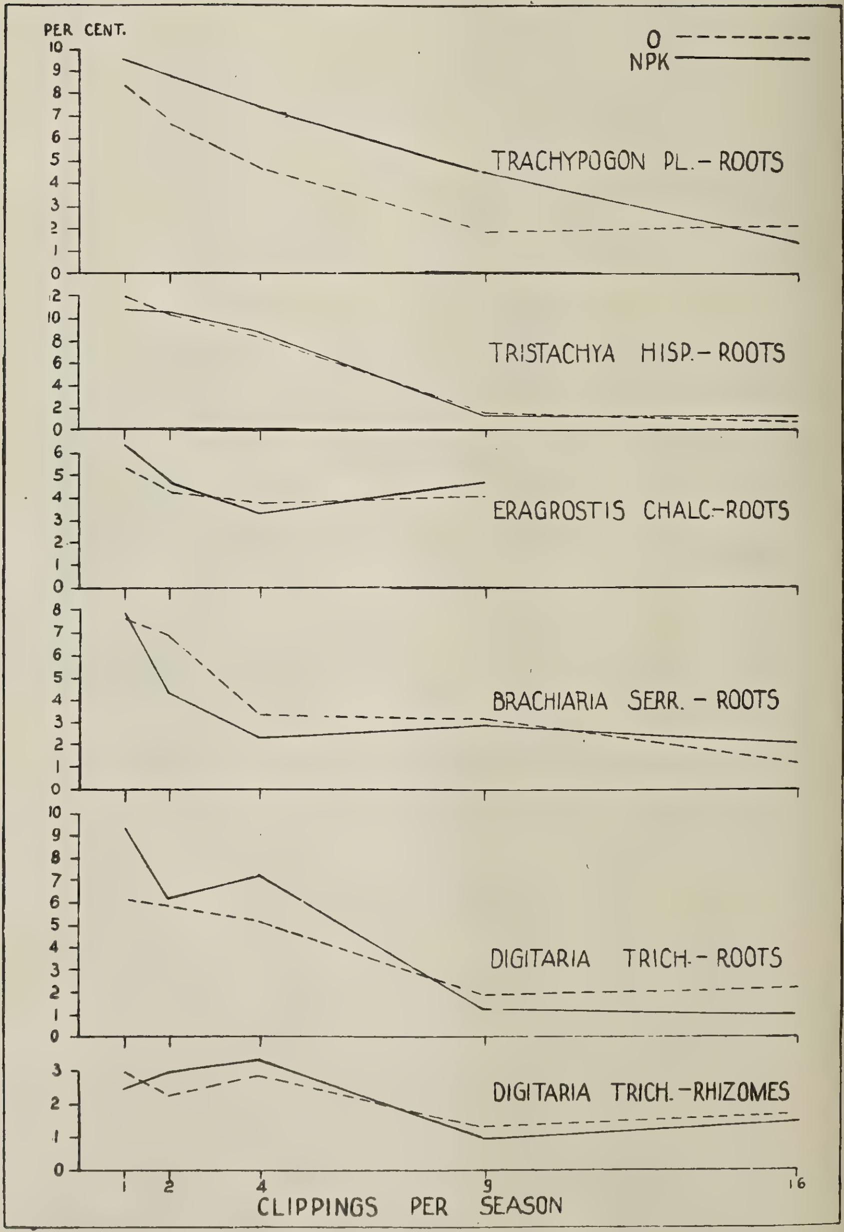

Fig. 2. Combined percentages of sugars and starch in roots and rhizomes, in relation to clipping frequency.

weights reported in this paper, though only being relative, can be regarded as representative and comparable.

*Sugar and Starch Content.*—Table IV gives the percentages of sugars and starch in the roots and rhizomes collected. It is evident that these compounds decreased in roots and rhizomes with the frequency of clipping. Though the different types of storage carbohydrates (reducing sugars, non-reducing sugars and starch) were not always affected by the various clipping treatments in the same way or to the same extent, the total percentages of sugars and starch (Fig. 2) definitely decreased with the number of clippings per season. In some cases the percentage of carbohydrates was somewhat higher in the roots of frequently cut plants than in the roots of plants cut fewer times. Thus, in *Eragrostis chalcantha* the combined percentages of sugars and starch in the roots of plants clipped nine times a season exceeded those in the roots of plants clipped four times a year ; no analysis could be carried out on the roots of *Eragrostis* plants cut sixteen times a year on account of the small amounts of root material recovered in this treatment. The significance of the apparent increase in carbohydrates with increased clipping frequency in some of the species will be discussed below. Fertilizer exerted, on the whole, little influence on the percentages of sugars and starch in the roots, with the possible exception of *Trachypogon plumosus*, where it increased the carbohydrate content under most conditions of defoliation.

Some interesting differences are shown between the various species as regards the occurrence and relative proportions of these reserve carbohydrates, largely confirming earlier results of the author (21, 22). In the storage organs of all species investigated reducing sugars occurred in considerably smaller amounts than non-reducing sugars. Whilst *Tristachya hispida* was found to store more starch in its roots than non-reducing sugars, the roots of the other grasses contained non-reducing sugars in excess of starch. The respective ratios of these carbohydrates were, however, frequently altered or even reversed under the abnormal conditions of excessive defoliation. In the rhizomes of *Digitaria tricholaenoides* fertilizer treatment changed the proportion of non-reducing sugars to starch. Thus in the rhizomes of unfertilized plants starch exceeded non-reducing sugars under all conditions of defoliation, but in the fertilized plants the percentages of starch were lower than those of non-reducing sugars, at least with one, two and four clippings per season.

*Acid-hydrolysable Polysaccharides.*—In contrast to sugar and starch contents, the percentages of acid-hydrolysable polysaccharides in the roots and rhizomes (Table V) remained largely unaffected by frequency of clipping. The fluctuations were generally small and rather irregular,

### TABLE V.

### ACID-HYDROLYSABLE POLYSACCHARIDES IN ROOTS AND RHIZOMES.

EXPRESSED AS PERCENTAGES OF COMBUSTIBLE DRY MATTER.

| Number of cuts per season. | | 1 | 2 | 4 | 9 | 16 |
|---|---|---|---|---|---|---|
| Trachypogon pl., | O | 17·9 | 17·5 | 18·9 | 19·1 | 21·4 |
| Roots | NPK | 17·5 | 17·7 | 17·5 | 18·9 | 18·5 |
| Tristachya hisp., | O | 19·3 | 17·2 | 13·5 | 22·9 | 22·3 |
| Roots | NPK | 17·9 | 16·3 | 17·5 | 22·6 | 20·8 |
| Eragrostis chalc., | O | 21·8 | 20·3 | 19·3 | 22·1 | — |
| Roots | NPK | 20·4 | 20·5 | 21·2 | 19·3 | — |
| Brachiaria serr., | O | 19·9 | 22·9 | 21·6 | 20·3 | 21·7 |
| Roots | NPK | 18·0 | 16·4 | 14·5 | 16·9 | 14·7 |
| Digitaria trich., | O | 15·6 | 15·5 | 18·7 | 16·9 | 14·7 |
| Roots | NPK | 18·2 | 16·8 | 17·0 | 18·2 | 21·3 |
| Digitaria trich., | O | 26·4 | 23·3 | 26·2 | 27·3 | 24·9 |
| Rhizomes | NPK | 27·4 | 27·9 | 26·1 | 26·6 | 27·6 |

and must be put down to certain inaccuracies of the method employed in determining these substances, which are often referred to as "hemicelluloses". Similarly, Aldous (1), McCarty (9) and Weinmann (22) found that clipping of the herbage did not reduce the percentages of acid-hydrolysable polysaccharides in the roots. It can, therefore, be concluded that these substances function in the roots mainly as structural materials, but cannot be utilised as food reserves. This view has also been expressed previously by McCarty (10) and by McCarty and Price (11). A noteworthy feature is that the more woody character of the rhizomes of *Digitaria tricholaenoides* is reflected by a higher content in acid-hydrolysable polysaccharides and a lower proportion of reserve carbohydrates as compared with the roots of the same and the other species of grasses.

*Combined Amounts of Sugars and Starch.*—Sugars and starch were reduced by frequent clipping not only in percentage but even more in actual amount since the root weights likewise decreased with the frequency of defoliation (Table VI and Fig. 3). In most cases where sugars and starch increased in percentage with increased frequency of clipping they still decreased considerably in actual amount, as shown, for instance, by *Eragrostis chalcantha* when four and nine clippings per season are compared. The apparent increase in the percentages of sugars

## TABLE VI.

## COMBINED AMOUNTS OF SUGARS AND STARCH IN ROOTS AND RHIZOMES.

MILLIGRAMS SUGARS AND STARCH IN ROOTS PER ONE SQUARE DECIMETRE BASAL AREA.

| Number of cuts per season. | | 1 | 2 | 4 | 9 | 16 |
|---|---|---|---|---|---|---|
| Trachypogon pl. .. | O | 399 | 357 | 128 | 15 | 14 |
| | NPK | 635 | 493 | 220 | 28 | 6 |
| Tristachya hisp. .. | O | 590 | 675 | 310 | 38 | 20 |
| | NPK | 817 | 1,010 | 632 | 26 | 15 |
| Eragrostis chalc. .. | O | 196 | 155 | 90 | 11 | — |
| | NPK | 462 | 443 | 80 | 12 | — |
| Brachiaria serr. .. | O | 780 | 1,040 | 55 | 20 | 25 |
| | NPK | 963 | 477 | 26 | 32 | 21 |

MILLIGRAMS SUGARS AND STARCH IN ROOTS AND RHIZOMES OF *Digitaria trich.* PER ONE METRE RHIZOME LENGTH.

| Number of cuts per season. | | 1 | 2 | 4 | 9 | 16 |
|---|---|---|---|---|---|---|
| Roots .. .. .. | O | 37·6 | 34·4 | 24·8 | 5·1 | 3·9 |
| | NPK | 146·8 | 100·8 | 70·7 | 3·2 | 0·9 |
| Rhizomes .. .. | O | 320 | 240 | 293 | 108 | 136 |
| | NPK | 326 | 384 | 261 | 64 | 90 |

and starch in this species between four and nine clippings is easily explained : with nine clippings many of the depleted and weakened roots died and subsequently decomposed. This proportion of the roots was naturally lost, whilst the remaining less affected root portion possessed a higher percentage of sugars and starch than the bigger mass of roots left intact in the quadrats cut four times per season.

The lowest amounts of sugars and starch were present in all cases with the highest number of clippings employed, except in the rhizomes of *Digitaria tricholaenoides,* where somewhat higher amounts were found with sixteen cuts per year than with nine. No other explanation can be given for this than that it may be due to a sampling error or to the fact that in this species the values were based on rhizome length instead of

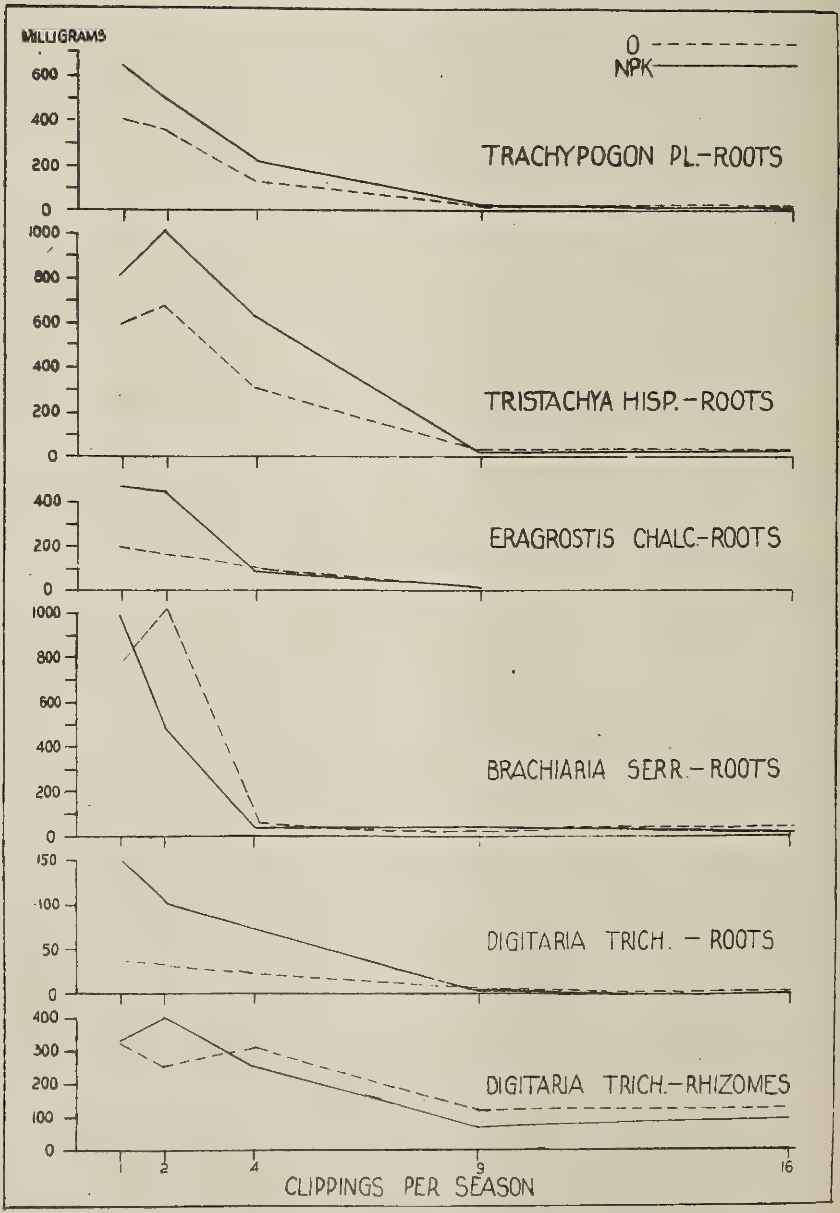

Fig. 3. Combined amounts of sugars and starch in roots and rhizomes, in relation to clipping frequency.

on basal area. The combined amounts of sugars and starch in the rhizomes of the *Digitaria* plants cut nine or sixteen times a year were, however, in either case still considerably lower than in the rhizomes of less frequently clipped plants. Even so it would appear that the rhizomes of *Digitaria tricholaenoides* responded to the clipping treatments in a different way to the roots of this and the other species.

Frequent clipping lowered the rhizome weights of *Digitaria tricholaenoides* and their carbohydrate content to a considerably lesser extent than it did in the case of the roots of all species. Clipping sixteen times per season reduced the combined amounts of sugars and starch in the roots of all species to a level approximating zero. The rhizomes of *Digitaria tricholaenoides*, however, retained a relatively large residue of reserve carbohydrates under the same severe conditions of defoliation. In spite of the low percentages of these substances it seems that *Digitaria tricholaenoides* possesses in its rhizomes considerable stores of reserve foods. This, together with its prostrate habit which protects the plant to a certain extent from unduly severe defoliation by grazing animals, may partly account for the fact that " the spreading of *Digitaria tricholaenoides* is encouraged by comparatively heavy grazing " (20). Graber (3) pointed out that plants with prostrate growth habit are more resistant to close mowing or grazing than erect plants, since a greater portion of the total leaf area is left intact after each defoliation. In the present experiment care was taken to remove all leaves uniformly at every cutting in all species tested. Hence, it may be concluded that the stores of carbohydrates in the rhizomes of *Digitaria tricholaenoides* are so large that they will not suffer the same degree of depletion by a cutting treatment which will almost completely exhaust the storage organs of the other species studied.

The combined amounts of sugars and starch were under conditions of moderate defoliation in most cases (except *Brachiaria serrata*) higher in the roots of fertilized plants than in those from unfertilized plots, but with excessive defoliation this was largely reversed. The fact that the residues of the combined amounts of sugars and starch in the roots of very frequently clipped plants were lower in the NPK-series than in the O-series seems to support the view that fertilizer treatment tends to aggravate the depletion of organic reserves brought about by frequent clipping (5, 6, 8). From the practical point of view, however, these differences appear to be mostly small and insignificant ; also, no such effect could be observed in *Eragrostis chalcantha*, though here the amounts of roots remaining after sixteen clippings per season were too small to be determined accurately or to be analysed. At any rate, it may be safely said that application of fertilizers was not able to counteract the depletion of root reserves caused by frequent clipping.

*Exhaustion of Root Reserves in Relation to Herbage Growth.*—The reduction in root weights and the exhaustion of organic reserves by excessive defoliation was associated with corresponding reductions of the total herbage yields, which were progressively diminished with increased frequency of clipping in both seasons. The yield reduction in the quadrats cut nine or sixteen times a season was more pronounced in the second than in the first year of treatment, indicating a cumulative and permanent effect. On the fortnightly clipped quadrats growth and regeneration stopped almost completely in the later half of the second season ; many of the plants had apparently been killed by the severe treatment of defoliation (23). In fact, on these quadrats a number of plants had disappeared altogether by the time their roots were to be harvested, and few or no roots were found, since the plants had died and decomposed. This was particularly the case with *Eragrostis chalcantha*, and is probably due to the fact that this species possesses a rather small and superficial root system. In this species 80 per cent. of the marked plants had disappeared completely in the quadrats subjected to cutting at fortnightly intervals, and even in the quadrats clipped at monthly intervals the loss was 40 per cent.

As previously pointed out by the writer (22), the reduction of root weights and the depletion of carbohydrate reserves in the roots by excessive defoliation is mainly due to two causes. Frequent clipping at short intervals will not permit of the normal storage of root reserves, since such storage usually takes place during the later part of the growing period, i.e. after flowering and during maturation (21). Secondly, the frequent repetition of the shooting process brought about by excessive clipping will result in an increased mobilisation and upward translocation of existing root reserves. In this way, excessive defoliation will gradually lead to carbohydrate starvation, reduced vigour and power of regeneration, and in extreme cases to the death of the plants.

## SUMMARY.

The results are reported of an experiment designed to test the effects of clipping frequency, with and without fertilizer treatment, on root development and carbohydrate reserves of five important South African Highveld grasses growing under natural conditions. The species tested were *Trachypogon plumosus*, *Tristachya hispida*, *Eragrostis chalcantha*, *Brachiaria serrata* and *Digitaria tricholaenoides*. Five different clipping

treatments were employed, namely cutting once, twice, four, nine and sixteen times per season for two years.

Increased frequency of clipping significantly reduced the root and rhizome weights and lowered the percentages of reducing sugars, non-reducing sugars and starch in these organs. The percentage of acid-hydrolysable polysaccharides remained unaffected by the frequency of clipping.

Fertilizer treatment increased the root weights of some of the species under conditions of moderate defoliation, but had generally little effect on the carbohydrate content.

Cutting at fortnightly intervals (or sixteen times per season) for two years led to an almost complete exhaustion of root reserves and to the death of many plants. Fertilizer treatment was not only unable to counteract these effects of excessive defoliation, but rather tended to aggravate them.

Weights and carbohydrate content of the rhizomes of *Digitaria tricholaenoides* were found to be less affected by frequent clipping than those of the roots of the same and other species.

The depletion in root reserves brought about by frequent clipping was associated with corresponding reductions in the herbage yields.

## ACKNOWLEDGMENTS.

The writer wishes to express his sincere thanks to Professor J. Phillips, Head of the Department of Botany in the University of the Witwatersrand, for his interest and for the facilities provided for this research ; to Mr. D. Meredith for checking the manuscript ; and to the National Research Council and Board of South Africa for financial assistance.

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# PLANTAE NOVAE AFRICANAE.

"Ex Africa semper aliquid novi."—*Pliny.*

## SERIES XXII.

By

Miss F. M. Leighton, B.Sc., and Paymaster-Captain
T. M. Salter, R.N. (Ret.).

**Elsiea** Leighton gen. nov. Liliacearum.

*Bulbi* elongati e basibus foliorum hornotinorum compositi, caudicibus longe persistentibus. *Folia* radicalia elongata, synantha. *Inflorescentia* racemosa. *Perianthii segmenta* connata. *Filamenta* tubi faucibus adnata; *antherae* dorsifixae. *Ovarium* obconicum. *Capsula* acute angulata. *Semina* atra planiuscula.

Superficially these plants resemble Ornithogalum but differ in the following respects :—

1. The perianth has a distinct tube at the base, to which the filamenst are attached. Although the perianth is persistent it does not envelop the fruit, but tends to spread and leave the capsule exposed.

2. The capsule is stipitate and the seeds are flatter than in Ornithogalum.

3. The axis of the bulb persists at the base and may form a fairly long underground stem from which both fibrous and fleshy roots arise. This character may be connected with the swamp conditions in which these plants grow.

4. The elongated bulbs are composed of few scales which are the bases of the existing leaves. Occasionally there are one or two scales from previous leaves.

If the definition of the genus Ornithogalum is modified to include these plants it will become even more unwieldy and heterogeneous than it is at present. There are other species now placed in Ornithogalum which, when fresh material is available for study, may prove to belong to Elsiea.

The genus is named in honour of Miss Elsie Esterhuysen of the Bolus Herbarium, whose collections have formed a valuable contribution to the knowledge of the flora of the higher mountains of the South-Western Cape.

## KEY TO THE SPECIES.

| | |
|---|---|
| Inflorescence corymbose, bracts much shorter than pedicels | 1. *corymbosa*. |
| Inflorescence spicate, bracts equal to, or exceeding pedicels | 2. *Flanaganii*. |

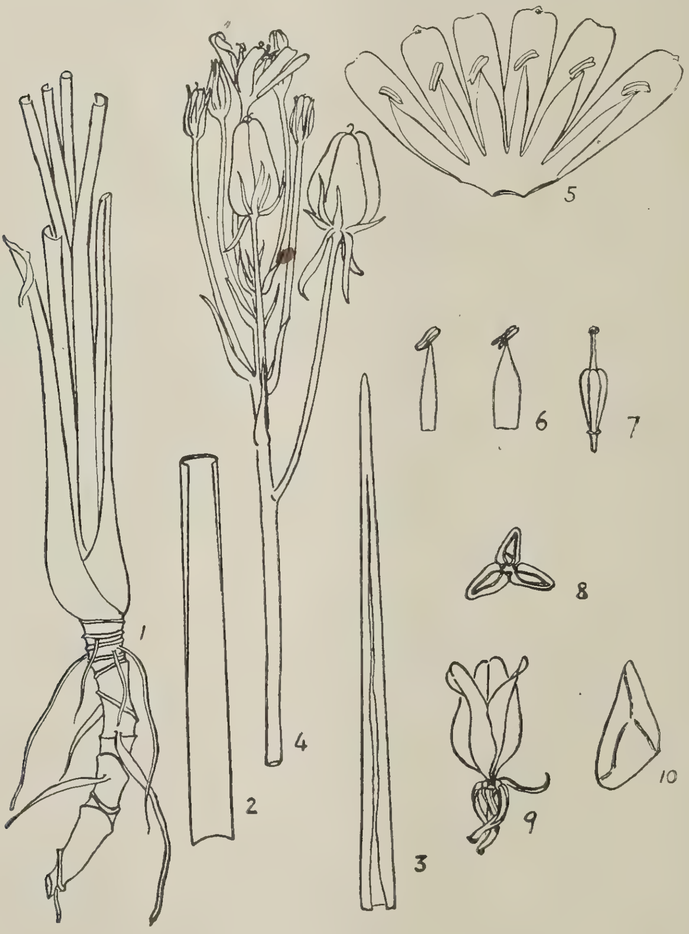

FIG. 1. *Elsiea corymbosa.* 1. Bulb and underground stem ×1. 2 & 3. Base and tip of leaf ×1. 4. Inflorescence ×1. 5. Perianth × 2. 6. Stamens × 2. 7. Gynaecium × 2. 8. Transverse section of half-ripe fruit × 2. 9. Ripe capsule × 2. 10. Seed × 4.

1. **Elsiea corymbosa** Leighton.

Planta alt. ad 70 cm. *Bulbus* elongatus ; *caudex* persistens, foliorum delapsorum cicatricibus annularibus numerosis circumcingentibus indutus. *Radices* fibrosi vel carnosuli. *Folia* linearia, erecta, glabra, canaliculata, marginibus incurvis, apicibus teretibus. *Inflorescentia* erecta, corymbosa. *Bracteae* pedicellis breviores. *Perianthium* album, segmentis patentibus, obtusis. *Stamina* subaequalia in tubi faucibus adnata. *Ovarium* obconicum substipitatum. *Stylus* crassiusculus ; *stigma* capitatum, papillosum. *Capsula* acute angulata, stipitata. *Semina* atra, planiuscula.

Plants up to 70 cm. high, usually about 40—50 cm. Bulb-scales elongate, almost imbricate, since they encircle the axis only at the base. The axis of the bulb persists, forming an underground stem on which the scars of old leaves are conspicuous. This stem gives rise to both fibrous and fleshy roots. Leaves 3—5, synanthous, linear erect, glabrous, channelled down the upper face, rounded on the under side, margins infolded, apices terete, 15—40 cm. long, up to 14 mm., usually 6—10 mm wide. Inflorescence erect, corymbose, flowers few to many, crowded. Bracts shorter than the pedicels. Pedicels 15—50 mm. long. Perianth white 10—14 mm. long ; segments obtuse 3—3.5 mm. wide, spreading in the upper half, joined near base to form a tube 3—4 mm. long. Stamens inserted at the throat of the tube ; filaments 6—8 mm. long, 3 outer about 1 mm., 3 inner about 2 mm. broad. Ovary obconic, substipitate. Style shorter than the ovary, stigma capitate, papillose. Capsule sharply angled, stipitate, depressed at the apex. Seeds flattish, almost winged round the edges. Perianth persistent, somewhat reflexed and exceeded by the capsule. Fl. Dec.—Jan.

*Hab.* Cape Province : Stellenbosch Div. ; swamps south-west of Victoria Peak (burnt a year before) 3000—3500 ft. *Esterhuysen* 9783. (*Type*, in Bolus Herbarium and National Botanic Gardens Herbarium); swampy ground (previously burnt), south-west slopes of Victoria Peak. *Esterhuysen* 9787. Ceres Div. : Summit of Mostert's Hoek Twins 6400 ft. *E. Wasserfall* 790 (National Botanic Gardens Herbarium).

2. **Elsiea Flanaganii** (Bak.) Leighton comb. nov.

Plants 15—20 cm. high, bulb long-ovoid 10—12 mm. diam. Roots produced from the persistent bulb axis. Leaves usually 2, one short and broad 3—5 cm. long, 3—5 mm. broad, one linear, ciliated when young on the margins and the ribs, 10—30 cm. long, 2—3 mm. broad. Peduncle slender, raceme few-flowered. Pedicels short ascending, bracts broadly ovate, equal to or exceeding the pedicels. Perianth white, funnel-shaped 10—14 mm. long, segments obtuse, joined at the base to form a tube 2 mm. long. Stamens 5—6 mm. long, filaments subequal, inserted at the throat of the perianth tube. Ovary obconic. Capsule sharply angled, stipitate. Seeds black, rugose. Fl. Dec.—Jan.

*Hab.* Natal: Summit of Mont aux Sources; *Flanagan* 2028. (*Type*): *Esterhuysen* Bolus Herb. 22805.

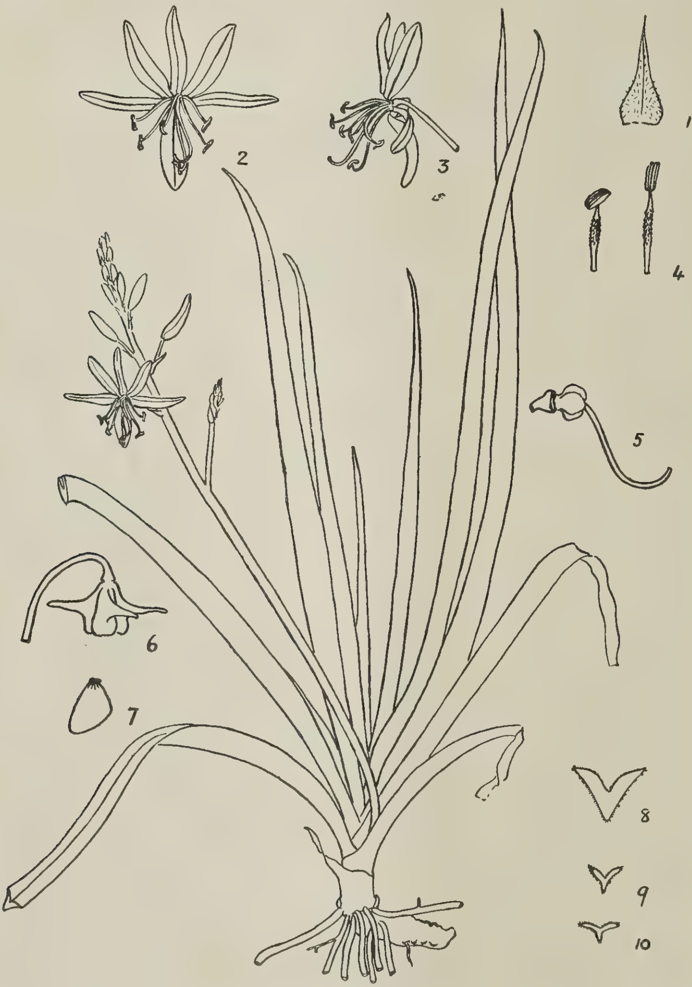

Fig. 2. *Anthericum Giffenii* × ½. 1. Bract × 2. 2, 3. Flower × 1. 4. Stamens × 2. 5. Gynaecium × 2. 6. Fruit—almost ripe × 1. 7. Seed × 4. 8, 9, 10. Cross-sections of leaf near base, middle and apex respectively × 1.

**Anthericum Giffenii** Leighton (Liliaceae).

Planta alt. 25-50 cm. *Rhizoma* inclinatum radicibus subcarnosis. *Folia* longa, erecta, triquetra, canaliculata, pilosa, acuta. *Scapus* simplex vel ramosus, pilosus. *Racemus* laxus. *Bracteae* membranaceae, sparse pilosae. *Pedicelli* apice articulati. *Perianthium* album, segmentis reflexis, inferne viridi- vel brunneo-nervatis. *Filamenta* muricata. *Capsula* cornuta, sparse glanduloso-pilosa, cornibus patentibus, in medio loculi positis, loculis 1—2 spermis, seminibus brunneis.

Plants 25—50 cm. high. Rhizomes fairly stout, with somewhat fleshy roots. Leaves 10—12 to a shoot, bases clasping and encircling the shoot, laminae triquetrous, erect when young, often drooping or recumbent with age, surface densely but softly pilose, each face 8—14 mm. diam. Inflorescence a lax, simple or branched raceme varying greatly in length from 25—150 cm. This factor depends on whether the plant is growing under favourable conditions. Flowers often about 3 cm. diam. Perianth-segments white with a greenish median stripe which turns red-brown as the flower fades, 14—16 mm. long, three outer segments 2—3 mm. wide, three inner 3—5 mm. wide. Stamens unequal, 5—11 mm. long, filaments muricated. Ovary depressed, triquetrous, each loculus producing a lateral horn 4—5 mm. long as the fruit develops. Capsule opens widely, 1—2 seeds in each chamber, seeds brownish with a well marked hilum. Fl. Sept.—March.

*Hab.* Cape Province: Victoria East Div.; Shady places in kloof and on dry hillside, on farm Naude's Hoek. *Giffen* 783 (July 1943). (*Type* in Bolus Herbarium and Herbarium National Botanic Gardens); *Giffen* 783b, coll. Oct. 1943.

Mr. M. H. Giffen of the South African Native College, Fort Hare, who collected this plant, has sent very ample and well prepared material, as well as notes and sketches which have been of great assistance in preparing the description. The plant from which the figures were drawn was grown in a pot at the Bolus Herbarium and the perianth seems to be narrower and somewhat differently orientated from those grown and sketched by Mr. Giffen. He states that the flowers open between 2 and 3 p.m. and close between 6 and 8 p.m. on bright sunny days. In dull weather they may not open at all.

This species differs from *Anthericum pilosum* Baker in the following respects —:

1. *A. Giffenii* has softer leaves with denser hairs.
2. *A. Giffenii* has hirsute bracts.
3. The capsules of *A. Giffenii* are horned.

**Drosera curviscapa** Salter. var. **Esterhuysenae** Salter, var. nov.

A forma typica ita differt :—*Foliorum* superficies superior in dimidio inferiore omnino glabra : tentacula exteriora incurva in folii dimido superiore in annulo ovali disposita, ea lacunae ovalis intervenientis glandibus paene sessilibus induta.

Differs from the typical form as follows :—*Leaves* cuneate-oblong, 1—2.5 cm. long, 3—8 mm. broad, green, densely adpressed-pubescent with long hairs beneath, ciliate, the upper surface entirely glabrous on the lower half : tentacles situated on the upper half of the leaf only, those at or near the margins long, curving inwards, forming a dense raised oval ring surrounding a central oval hollow space 2.5—6 mm. long and 2—4 mm. broad, dotted with numerous almost sessile glands.

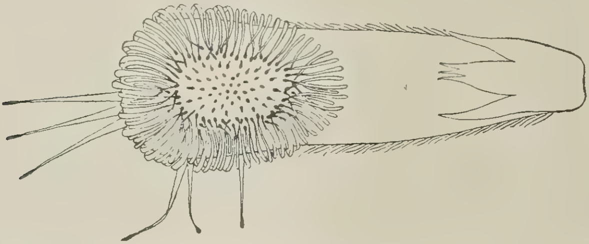

Fig. 3. *Drosera curviscapa,* var. *Esterhuysenae.* Upper surface of a leaf, showing the stipule and the position of the tentacles, a few of those on the margin spread out × 3. (*Esterhuysen* 9802). *Del.* T.M.S.

*Hab.* Cape Province : border of Stellenbosch and Caledon Divisions ; Hottentots Holland, on sandy slopes north-east of Sneeuwkop and between Sneeuwkop and Guardian Peak, about 3,000 ft., *Esterhuysen* 9802 (*type* in Bolus Herbarium) : between Sneeuwkop and Landdrostkop, *Esterhuysen* 1368. Fl. Dec.—Jan.

Though identical in its stipules, curving scape and floral characters with the typical form of *D. curviscapa*, which was described in Vol. V (1939) pp. 158—161 of this Journal, this well marked variety can at once be distinguished by the arrangement of the tentacles, which gives the leaves a somewhat spoonlike appearance. As in the typical form the tentacles around the anterior margin differ from the remainder, being longer, wider at the base and bearing narrow-linear glands, on the largest leaves nearly 1 mm. long. It appears to grow in drier situations than the typical form.

# NOTES ON SOME GENERA OF THE THYMELAEACEAE.

by

E. P. Phillips.

In an attempt to draw up descriptions of the genera of *Thymelaeaceae* for a new edition of the " Genera of South African Plants " an examination of all the specimens in the National Herbarium was undertaken. So far as the genera *Gnidia*, *Lasiosiphon*, and *Arthrosolen* are concerned two courses are open, (1) either to place all the species into one heterogeneous genus *Gnidia* as was done by Gilg in the Pflazenfamilien, and accepted by the late Prof. C. E. Moss (MSS.) or (2) to keep the genera distinct as is done in the " Flora Capensis " and the " Flora of Tropical Africa ". The latter course is, in the opinion of the writer, preferable and reasons for this will be given later. That the three genera are closely related there can be no doubt and some species also indicate an affinity with the genus *Struthiola*. For example, two plants placed in the genus *Gnidia* (*G. aberrans* C.H.W. and *G. anomala* Bolus) have the stamens the same number as the calyx-lobes—a character of *Struthiola*—while the plant described as *Gnidia pulvinata* Bolus has stamens twice as many as the calyx-lobes, but has the stiff hairs surrounding the petals, also a character of *Struthiola*. Species placed in the genus *Lasiosiphon* occasionally have flowers with four calyx-lobes—a character of *Gnidia*—and a specimen of *Arthrosolen polycephalus* (National Herbarium No. 27177) has flowers with 4 calyx-lobes instead of the normal five. *Arthrosolen polycephalus* also occasionally has flowers with obsolete petals (see specimen from Rustenburg in National Herbarium No. 27176). There thus exists some justification for regarding *Gnidia*, *Lasiosiphon*, *Arthrosolen* and perhaps even *Struthiola* as co-generic.

With regard to the genera *Gnidia* and *Lasiosiphon* the conclusions are based on the material in the National Herbarium. The distribution of the genera should not be overlooked ; the species of *Gnidia* are massed at the Cape with some species extending to the high mountain regions of the eastern Transvaal with outliers found at Heidelberg and the Witwatersrand e.g. *Gnidia fastigiata* Rendl. *fide* the " Flora Capensis ". (Note.—Mrs. M. Moss considers this a wrong determination.) This distribution is not at all unusual and is similar to that of many genera of other families. The genus *Lasiosiphon* is massed on the High Veld, though species extend to the Transkei and one species *Lasiosiphon linifolius* Decne is found in the Alexandria district of the Cape Province, but may be distinguished from *Gnidia* by the peduncled heads surrounded by bracts. While their is a certain amount of intermingling of some species of *Gnidia* and *Lasiosiphon*, their areas of concentration are distinct. It should be observed that the names given above are those of the " Flora Capensis ".

Both Wright in the " Flora Capensis " and Pearson in the " Flora of Tropical Africa " rely on the presence or absence of petals to distinguish the genera. This in the writer's opinion is an unstable character and leads to closely related plants being placed in separate genera. For example *Gnidia microcephala* Meisn. and *Arthrosolen polycephalus* C.A. Mey. are obviously closely related species but placed in different genera in the "Flora Capensis" because petals are present in the first and absent in the second. In the genera *Gnidia* and *Lasiosiphon* which normally have petals present, these vary from structures almost as large as the calyx-lobes to much reduced though evident structures. It appears justifiable to assume that in some species the reduction may be complete, as the rudiments in the specimen of *Arthrosolen polycephalus* quoted above indicate. The character which appears to be constant, so far as the writer is able to judge from all the specimens dissected, is the number of stamens. There appears to be only one species (*Gnidia Harveyana* Meisn.) in which the upper stamens are represented by filaments only but this would still warrant keeping the species in the genus *Gnidia*. *Gnidia anomala* Meisn. has no trace of staminodes and the key to the species in the " Flora Capensis " is incorrect to that extent.

The writer comes to the conclusion that the number of stamens and the number of the calyx-lobes, in conjunction with other considerations such as distribution and general similarity, must be taken as characters to separate the genera *Gnidia*, *Lasiosiphon*, *Arthrosolen*, and *Struthiola*. As pointed out above the evidence from the material examined indicates that the number of the stamens in relation to the number of the calyx-lobes is a constant character and should therefore be accepted as the basis for segregation.

Accepting the above conclusion it becomes necessary to describe three new genera for the inclusion of certain species.

The genera *Arthrosolen*, *Gnidia*, and *Lasiosiphon* as described in the " Flora Capensis " must then be amended as follows :—

*Arthrosolen* C.A. Mey. (emend.) includes the first three species of the " Flora Capensis " together with *Gnidia microcephala* Meisn.

*Gnidia* Linn. (emend.) as in the " Flora Capensis " with the exclusion of *G. anomala* Meisn., *G. pulvinata* Bolus, *G. aberrans* C.H.W. and the inclusion of species 4 to 11 under *Arthrosolen* in the " Flora Capensis ".

*Lasiosiphon* Fresn. As in the " Flora Capensis ".

The above regrouping of the genera necessitates some changes in nomenclature as under :—

| | | |
|---|---|---|
| *Arthrosolen ornatus* Meisn. | becomes | *Gnidia vesiculosa* E. & Z. |
| *A. spicatus* C.A. Mey. | ,, | *G. spicata* (L.f.) Gilg |
| *A. fraternus* N.E. Br. | ,, | *G. fraterna* (N.E.Br.) Phill. |
| *A. laxus* C.A. Mey. | ,, | *G. laxa* (L.f.) Gilg |
| *A. gymnostachys*, C.A. Mey. | ,, | *G. gymnostachya* (C.A.Mey.), Gilg |
| *A. variabilis* C.H.W. | ,, | *G. variabilis* (C.H.W.) Phill. |
| *A. phaeotrichus* C.H.W. | ,, | *G. phaeotricha* Gilg |
| *A. inconspicuus* Meisn. | ,, | *G. meisneriana* Phill. comb. nov. |
| *A. deserticola* (Gilg) Compton | ,, | *Lasiosiphon deserticola* (Gilg) C.H.W. |
| *Gnidia microcephalus* Meisn. | ,, | *Arthrosolen microcephala* (Meisn.) Phill. |
| *G. anomala* Meisn. | ,, | *Pseudognidia anomala* (Meisn.) Phill. |
| *G. aberrans* C.H.W. | ,, | *Basutica aberrans* (C.H.W.), Phill. |
| *G. pulvinata* Bolus | ,, | *Struthiolopsis pulvinata* (Bolus) Phill. |

**PSEUDOGNIDIA** Phillips gen. nov. Affinis *Gnidia* sed staminibus 4, differt.

*Tubus calycis* cylindricus, basi articulatus, pilosus ; lobi 4, lanceolati. *Petala* 8, crassa, linearia. *Stamina* 4. *Ovarium* ovatum, glabrum ; stylus filamentosus ; stigma simplex.

Suffrutex sericeus ; folia opposita, elliptica vel oblongo-elliptica ; flores solitarii, axillares.

Cape Province :—Distribution as in " Flora Capensis ", *Drege* 7348a (Typus).

*Calyx-tube* long cylindric, slightly widened above, sub-globose at the base and articulated above the globose portion, pilose ; lobes 4, lanceolate, much shorter than the tube. *Petals* 8, fleshy, shorter than the calyx-lobes, linear. *Stamens* 4, inserted in the upper part of the calyx-tube ; filaments much shorter than the anthers ; anthers linear, with an apical gland which is soon deciduous. *Ovary* somewhat ovate in outline, 1-chambered, with a single ovule, glabrous ; style inserted laterally, filamentous, about $\frac{3}{4}$ as long as the calyx-tube; stigma simple, with a few glandular hairs.

Differs from the genus *Gnidia* in having only 4 stamens. The new combination will now be **Pseudognidia anomala** (Meisn.) Phill.=*Gnidia anomala* Meisn.

**BASUTICA** Phillips gen. nov. Affinis *Gnidia* sed staminibus 4 differt.

*Tubus calycis* infundibuliformis, pilosus; lobi 4, oblongo-elliptici. *Petala* 4, crassa, oblonga. *Stamina* 4. *Ovarium* leviter ellipsoideum, supra pilosum; stylus filamentosus; stigma simplex.

Suffrutex; folio alternata, ericoidea; flores solitarii, axillares.

Eastern Mountain Region:—Basutoland, *Staples* in *National Herbarium* 27178; Drakensberg, *Thode* 79; Giant's Castle, Drakensberg, *Wylie* 10611 (typus).

*Calyx-tube* more or less funnel-shaped, pilose; lobes 4, oblong-elliptic. *Petals* 4, fleshy, shorter than the calyx-lobes, oblong. *Stamens* 4, fixed about $\frac{1}{2}$ way down the calyx-tube; anthers oblong, longer than the filaments. *Ovary* slightly ellipsoid, 1-chambered, with a single ovule, hairy above; style filamentous, about $\frac{3}{4}$ as long as the calyx-tube; stigma simple, minutely hairy.

The genus is separated from *Gnidia* by having only 4 stamens. The new combination will now be **Basutica aberrans** (C.H.W.) Phill.=*Gnidia aberrans* C.H.W.

**STRUTHIOLOPSIS** Phillips gen. nov. Affinis *Gnidia* sed petalis pluribus differt.

*Tubus calycis* cylindricus; lobi 4; *Petala* ∝, pilis rigidis cincta. *Stamina* 8, biseriata, inclusa. *Ovarium* ellipticum; stylus filamentosus; stigma pilosum.

Suffrutex; folia alternata, linearia vel lanceolata, pilosa; flores solitarii, axillares.

Cape Province:—Bredasdorp district, between Caledon and Elim, *Bolus* 9238 (type); Koude Rivier, *Schlechter* 9619.

*Calyx-tube* long cylindric, slightly widened at the base and articulated above the widened portion, pilose; lobes 4, ovate, much shorter than the tube. *Petals* many, somewhat fleshy, terete, or linear and arising from 4 cushions shorter than the calyx-lobes, surrounded by stiff hairs. *Stamens* 8, in 2 rows; the upper row sometimes functionless. *Ovary* elliptic, slightly hairy above; style filamentous, about $\frac{3}{4}$ as long as the calyx-tube; stigma lanceolate, hairy.

The presence of stiff hairs among the petals connects this genus with *Struthiola* but the stamens being double the number of the calyx-lobes excludes it from *Struthiola*. It differs from *Gnidia* in having many petals. [Type:—**Struthiolopsis pulvinata** (Bolus) Phill. = *Gnidia pulvinata* Bolus.]

**Struthiolopsis Bolusii** Phill. sp. nov. *Calyx* extra appresse pilosa; lobi 4, ovato-elliptici. *Petala* 3—6-lobata, pilis rigidis cincta. *Stamina* 8, biseriata, inclusa.

Suffrutex; folia lineari-lanceolata, flores solitarii, axillares.

Cape Province:—Caledon distr.: Houw Hoek, *Schlechter* 9402; Hottentots Holland, *Stokoe* in *Herb. Bolus* 22328; Caledon, *Marloth* 13193. Bredasdorp distr.: Bredasdorp, *Bolus* 7871, 8595 (type), *Galpin* 10464, 10506, 11289. Without locality, *Marloth* 8965, 13193.

## THE GENUS ENGLERODAPHNE Gilg

The "Flora Capensis" upholds the genus *Englerodaphne* Gilg but places under *Gnidia* a species, *G. ovalifolia* Meisn., which obviously belongs to the genus *Englerodaphne*. Burtt Davy was correct in separating certain specimens quoted in the "Flora Capensis" under *Gnidia ovalifolia* and describing them as *Englerodaphne pilosa*. There appears to be little doubt that all the specimens quoted as *Gnidia ovalifolia* in the "Flora Capensis" do not belong to the same species. The Gueinzius specimen and Pegler No. 166 have the inflorescence in the form of an ebracteate spike and the leaves, except the youngest, are glabrous. Tyson No. 1775 and Flanagan No. 2772 have the flowers in ebracteate heads and the leaves are permanently pilose. As Burtt Davy has put the latter into another genus (*Englerodaphne pilosa*) the former specimens must also be placed in *Englerodaphne* and require to be renamed as *E. ovalifolia* (Meisn.) Phill. = *Gnidia ovalifolia* Meisn. partly. There is no outstanding structural difference in the flower to separate *Englerodaphne* from *Gnidia*, but the two genera need never be confused as *Englerodaphne* has flat membranous leaves very different in texture to any species of *Gnidia* and the inflorescence is ebracteate.

## GNIDIA CEPHALOTES Licht. Mss. ex Meisn.

The name *Gnidia cephalotes* is a manuscript name of Lichtenstein's in the Willdenow herbarium, but was accepted by Meisner (DC. Prodr. vol. 14, p. 581) and the species described by him. Meisner l.c. cites two specimens of Zeyher's (Nos. 3743 and 3745) as belonging to the species and in his description he describes the petals (glands) as "glandulis 4 parvulis bifidis ". Through the courtesy of the Acting Director of the South African Museum Herbarium, Cape Town, I was able to examine two Zeyher specimens with the same numbers as above and find they do not agree with the description in the Prodromus ; the petals are four cushions each produced into 3—6 lobes and surrounded by hairs. The Curator of the Bolus Herbarium was good enough to allow me to examine the material named *Gnidia cephalotes* in the Bolus Herbarium. I found two specimens, viz., Esterhuysen No. 3633 and Stokoe No. 8022, which agreed with Meisner's description in having four petals slightly bifid, and these must therefore be taken as true *Gnidia cephalotes.* The remainder of the specimens, viz., Stokoe Nos. 6464, 6465 ; Bolus Herbarium Nos. 17484, 22783 ; Esterhuysen No. 3636 ; Schlechter No. 7219 ; Bolus Nos. 7871, 8595 are the same as Zeyher Nos. 3743 and 3745, and have several petals surrounded by hairs. I have only seen the Zeyher numbers and Schlechter 7219 and Bolus 8595 quoted in the " Flora Capensis " under *Gnidia cephlotes* but, as pointed out above, they do not agree with Meisner's description. Superficially the specimens with four petals and those with several petals look very much alike, but a closer examination, apart from the floral structure, reveals other differences.

Without reference to Willdenow's herbarium, it is impossible to make definite statements, but it is highly probable that the specimen (or specimens) to which Lichtenstein affixed his manuscript name, were not Zeyher's specimens. Meisner notes he saw a dried specimen (or specimens) in Willdenow's herbarium, and probably drew up his description on that material, and by comparison concluded the two Zeyher specimens were the same species. Such a mistake would be quite excusable. We are forced to accept the description given by Meisner as being applicable to the plant seen by Lichtenstein and which he named *Gnidia cephalotes*, and which had only four petals slightly bifid; the other specimens with several petals surrounded by hairs must be excluded. They are allied to the plant named by Bolus *Gnidia pulvinata* but which I consider should be generically separated from *Gnidia* and placed in the genus *Struthiolopsis* Phill.

In the " Flora Capensis " Wright followed Meisn. in accepting the Zeyher specimens as *Gnidia cephalotes* Licht. I have not seen the Mund specimen or Schlechter 9402 so cannot say whether or not they are *G. cephalotes* Licht. All the other specimens quoted by Wright must be excluded.

## KEY TO GENERA OF THYMELAEACEAE.

1. Ovary 2-chambered, rarely 3-chambered ; inflorescence an umbel. 1. *Peddiea* Harv.
   Ovary 1-chambered ; inflorescence a head or spike or flowers solitary .. 2
2. Stamens as many as the calyx-lobes .. .. .. .. .. .. .. 3
   Stamens twice as many as the calyx-lobes .. .. .. .. .. 5
3. Petals surrounded by stiff hairs .. .. .. 8. *Struthiola* Linn.
   Petals not surrounded by hairs .. .. .. .. .. .. .. 4
4. Leaves opposite ; petals 8 .. .. .. 5. *Pseudognidia* Phill.
   Leaves alternate ; petals 4 .. .. .. 6. *Basutica* Phill.
5. A small tree ; inflorescence a peduncled head surrounded by 2—6 bracts forming an involucre .. .. .. .. 13. *Dais* Linn.
   Shrubs or shrublets .. .. .. .. .. .. .. .. 6
6. Inflorescence a head surrounded by coloured membranous, not foliaceous, bracts .. .. .. .. .. .. 4. *Arthrosolen* C.A. Mey.
   Inflorescence, if a head, surrounded by foliaceous herbaceous bracts .. 7
7. Scales present at the base of the stamens .. .. .. .. .. 8
   Scales absent .. .. .. .. .. .. .. .. .. 9
8. Flowers solitary at the apex of the branches or in the axils of the upper leaves .. .. .. .. .. .. 10. *Cryptadenia* Meisn.
   Inflorescence usually a bracteate or ebracteate head, rarely a short dense spike or flowers solitary .. .. .. 11. *Lachnaea* Linn.
9. Petals many, mixed with hairs .. .. .. 7. *Struthiolopsis* Phill.
   Petals as many or twice as many as the calyx-lobes or none .. .. .. 10
10. Calyx-lobes 5, rarely 4 ; petals as many as the calyx-lobes, rarely none. 3. *Lasiosiphon* Fresn.
    Calyx-lobes 4 ; petals as many, twice as many as the calyx-lobes or none .. 11
11. Stigma mop-like ; leaves not membranous .. 12. *Passerina* Linn.
    Stigma simple, if sub-globose then leaves membranous .. .. .. 12
12. Leaves not membranous ; inflorescence usually bracteate. 2. *Gnidia* Linn.
    Leaves membranous ; inflorescence ebracteate 9. *Englerodaphne* Gilg

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# NOTES ON THE MINOR GENERA OF THE ERICACEAE.

By E. P. Phillips.

J. F. Klotzsch in " Linnaea " (Vol. 12) monographed the *Ericaceae* and described twenty-four new South African genera in the family, of which number N. E. Brown in the " Flora Capensis " retained thirteen and sunk the others in one or other of Klotzsch's remaining genera. Brown himself (*Flora Capensis*) described four further genera and retained five genera of older authors. The " Flora Capensis " thus recognised twenty-three genera of *Ericaceae* including the genus *Erica*. Brown in his key to the genera relied for his main groups on (1) the number of chambers in the ovary (2) the number of ovules in each ovary-chamber and (3) the number of stamens ; within those groups he relied mainly on variations in the calyx, corolla, stamens, number of ovary-chambers and vegetative characters to separate the genera. In the genus *Erica* which is accepted as being a natural genus, the five sub-genera, as described in the " Flora Capensis ", differ more among themselves in the shape of the calyx and corolla than do any of the other South African genera of the family and could be raised to generic rank with more justification than is warranted in the other genera. Yet so far as the writer has been able to ascertain only a few species of *Erica* have been placed in other genera, e.g. *Andromeda* Linn., *Microtrema* Klotz., *Macnabia* Benth., and *Nabia* Lehm., all of which except the first have been sunk in the genus *Erica*. In general appearance all the species in the twenty-two genera other than *Erica*, described in the " Flora Capensis " agree more among themselves in general appearance than do the species of *Erica*.

The writer considers that the number of ovules in the ovary-chamber, i.e. whether solitary or two or more, is a more important character than the number of ovary-chambers. Many examples could be given from other families where the number of ovary-chambers varies in flowers from the same inflorescence. The number of stamens is also an unstable character as will be seen from the descriptions of the genera under consideration and as given in the " Flora Capensis ".

In going through the genera in connection with the revision of " The Genera of South African Flowering Plants ", all the available species of *Ericaceae* were dissected and examined. As a result of that examination, the writer is of opinion that not more than eight genera, including *Erica*, are justified to accommodate the South African species. The genera to be retained are :—

1. *Vaccinium* Linn.
2. *Erica* Linn.
3. *Blaeria* Linn. (*Philippia* Klotz. ; *Ericinella* Klotz. ; *Thamnus* Klotz. ; *Coccosperma* Klotz.).
4. *Eremia* D. Don (*Platycalyx* N.E. Br. ; *Hexastemon* Klotz. ; *Arachnocalyx* Compton ; *Grisebachia* Klotz. ; *Acrostemon* Klotz. ; *Simocheilus* Klotz. ; *Thoracosperma* Klotz. ; *Aniserica* N.E. Br.).
5. *Sympieza* Licht.
6. *Scyphogyne* Brongn. (*Syndesmanthus* Klotz. ; *Anomalanthus* Klotz. ; *Eremiopsis* N.E. Br. ; *Lepterica* N.E. Br.).
7. *Salaxis* Salisb. (*Coilostigma* Klotz.).
8. *Lagenocarpus* Klotz.

It will be noted that the above grouping of the genera conforms to the grouping given in the Key to the genera in the " Flora Capensis ". It is the separation of the genera within the groups which the writer does not think justified.

1. An examination of the genus *Blaeria* Linn. and the genera grouped with it, as given above, indicates that they cannot be separated on any tangible characters. In the genus *Coccosperma* Klotz. the number of stamens may be from 2 to 6 ; in *Ericinella* Klotz., from 4 to 6 ; in *Philippia* Klotz. the number of stamens is 8. In the genus *Thamnus* Klotz., the ovary is 1-chambered with several ovules ; in *Coccosperma* Klotz., it is 1—3-chambered with 2 ovules in each chamber and in the other genera 4-chambered with 2 or more ovules in each chamber. The number of stamens, the number of ovary-chambers, and the number of ovules (2 or more) all vary and the genera in the group and as recognised in the " Flora Capensis " must be considered merely groups of species of one common genus. The question might legitimately be raised as to whether these genera can be separated from the genus *Erica*.

2. The genus *Eremia* D. Don and the genera grouped under it as above are all characterised by having a single ovule in each ovary-chamber. The number of ovary-chambers varies from 4 to 6. In *Eremia* the number of stamens is 8; in *Platycalyx* there may be 5 to 7; in *Hexastemon* the number is 6, while the other genera all have 4 stamens. The stigma in all is simple or sometimes slightly sub-capitate or sub-peltate.

3. The genus *Sympieza* Licht. is so distinct from any of the other genera owing to the flattened and 2-lobed calyx and the 2-lobed corolla that the writer suggests it should remain.

4. The genus *Lepterica* is separated by N. E. Brown from *Scyphogyne*, *Syndesmanthus* and *Anomalanthus* on the presence of 8 stamens in *Lepterica* and from 2 to 5 in the other genera. The 1-chambered ovary with a single ovule is the character which should unite these genera and the number of stamens or any other character may be used in separating the genus, in this case *Scyphogyne*, into subgenera or sections.

5. N. E. Brown in the Key to the genera (*Flora Capensis*) separates the genera *Salaxis* and *Coilostigma* on the number of stamens . In *Salaxis* the number may vary from 6 to 9 whereas in *Coilostigma* the number of stamens is 4. As we know from the other genera in the *Ericaceae*, the number of stamens is variable, and it is not a reliable character on which to separate *Coilostigma* from *Salaxis*.

6. The peculiar floral character found in *Lagenocarpus* Klotz. of the ovary being inferior to the corolla and not to the calyx as pointed out by N. E. Brown in the "Flora Capensis", would warrant it being kept distinct from all the other genera.

The genera as suggested above, can be keyed out as follows :—

## KEY TO THE GENERA :

| | | |
|---|---|---|
| 1. | Leaves broad, lanceolate, serrate | 1. *Vaccinium* Linn. |
| | Leaves ericoid | 2 |
| 2. | Ovary adnate to the corolla-tube | 8. *Lagenocarpus* Klotz. |
| | Ovary superior, free from the corolla-tube | 3 |
| 3. | Ovule solitary in each ovary-chamber | 4 |
| | Ovules 2 or more in each ovary-chamber | 7 |
| 4. | Ovary 1-chambered | 6. *Scyphogyne* Brongn. |
| | Ovary 2- or more-chambered | 5 |
| 5. | Calyx of lowest or of all flowers flattened, 2-lobed ; corolla 2-lobed | 5. *Sympieza* Licht. |
| | Calyx not as above ; corolla 4-lobed (rarely 2-lobed) | 6 |
| 6. | Stigma peltate, cup-shaped, or saucer-shaped | 7. *Salaxis* Salisb. |
| | Stigma simple (rarely sub-peltate, in which case bracts are present) | 4. *Eremia* D. Don |
| 7. | Calyx-lobes usually unequal ; if equal then stamens normally 4 | 3. *Blaeria* Linn. |
| | Calyx lobes equal ; stamens normally 8 | 2. *Erica* Linn. |

## AMENDED DESCRIPTIONS OF SOME GENERA.

**Blaeria** Linn., Sp. Pl., ed. 1, p. 112 (1753).

*Calyx* sometimes with a campanulate tube ; lobes or segments 3—4, often unequal. *Corolla* longer or scarcely as long as the calyx ; tube campanulate, tubular-campanulate, or tubular, often angled ; lobes 3—4, much shorter than the tube. *Stamens* 2—8, exserted or included ; filaments sometimes membranous or more or less rigid, linear or filiform, free or connate ; anthers shorter or longer than the filaments, free or connate, often spurred at the base, often minutely tuberculed, opening by oblique pores or slits, with the thecae divided to the base or almost so. *Ovary* 1—4-chambered, with 2—5, rarely more, ovules in each chamber ; style cylindric, usually exserted ; stigma simple, sub-capitate, peltate, or saucer-shaped. *Fruit* a 2—4-valved loculicidal capsule, sometimes unilocular, with 1 to few seeds in each loculus.

Shrubs or shrublets ; leaves ericoid, usually convex and grooved on the back, rarely open-backed ; inflorescence various ; flowers normally small ; bracts 2—3 or 0.

**Eremia** D. Don in Edinburgh New. Phil. Journ., vol. 17, p. 156 (1834).

*Calyx* lobed or partite almost to the base, rarely nearly flat and square in outline ; tube when present campanulate or tubular campanulate, sometimes angled or ribbed ; lobes or segments 4, shorter than the tube. *Corolla* slightly exceeding or much longer than the calyx ; tube urceolate, campanulate, cup-shaped, sub-globose, or tubular, often angled ; lobes 4, very rarely only 2, much shorter than the tube. *Stamens* 4—8, free, exserted from or included in the corolla ; filaments linear or filiform ; anthers 2-lobed or divided to the base, sometimes spurred, sometimes tuberculate or hirsute. *Ovary* 2—4-chambered, with 1 pendulous ovule in each chamber ; style cylindric or filiform, usually exserted ; stigma simple, sub-capitate, or sub-peltate, or minutely 4-lobed.

Small shrubs or shrublets ; leaves ericoid, convex and grooved on the back, rarely flat ; flowers small, in terminal clusters or on short lateral branchlets or in few-flowered globose heads, or 1—6 together ; bracts 1—3, sometimes absent.

**Scyphogyne** Brongn. in Duperrey Bot. Voy. Coquille, t. 54 (1829).

*Calyx-tube* campanulate or funnel-shaped, sometimes angled ; lobes 3—4, about as long as or much shorter than the tube. *Corolla* shorter or longer than the calyx ; tube campanulate, tubular, funnel-shaped or tubular or cylindric below and campanulate or globose above ; lobes

3—4, much shorter than the tube. *Stamens* 3—8, included or exserted; filaments sometimes membranous and connate or linear and free; anthers longer than the filaments, notched at the apex or bipartite to the base, with or without spurs, rarely with the connective produced and fleshy and glandular, opening by oblique pores or slits. *Ovary* 1-chambered, with a solitary pendulous ovule; style cylindric or linear, as long as the stamens or sometimes exserted; stigma simple, capitate or thickened or large and peltate or crater-like.

Small shrubs or shrublets; leaves ericoid, convex and grooved on the back; flowers very small, 1—3 together, axillary and terminal or several in small globose heads, sessile or shortly pedicellate; bracts 1—3 or 0.

**Salaxis** Salisb., Trans. Linn. Soc., vol. 6, p. 317 (1802).

*Calyx* divided almost to the base or with a saucer-shaped tube; lobes 4, unequal. *Corolla* shorter or longer than the calyx, often hairy; tube globose, urceolate, ovoid, cylindric, or campanulate; lobes 4, shorter than the tube. *Stamens* usually 4 or 8, more rarely 6 or 9, included or slightly exserted, often forming a ring within the corolla; filaments linear or sometimes membranous and oblong, variously connate or free; anthers lobed above or divided almost to the base, without spurs, opening by oblique slits or pores. *Ovary* 2—4-chambered, sometimes angled, with a solitary ovule in each chamber; style shorter than the stamens or exserted, sometimes becoming lateral in the fruit owing to the abortion of an ovary-chamber; stigma sometimes small, usually large, peltate, crater-like cup-shaped or saucer-shaped, sometimes completely covering the mouth of the corolla-tube. *Fruit* apparently indehiscent.

Small shrubs or shrublets; leaves ericoid, convex and grooved on the back; flowers small, often in small clusters; bracts present or absent.

# BOOK REVIEWS.

Reviews are printed below of four books recently published by the Chronica Botanica Company in " A New Series of Plant Science Books ", edited by Dr. Frans Verdoorn.

The periodical Chronica Botanica, The International Plant Science News Magazine, was begun in 1935 by Dr. Verdoorn in Holland, the home of internationalism. Early in the war the enterprise was transferred to the United States and has since been carried on with the greatest energy and success. The new series of books on different branches of plant science is the most noteworthy contribution to synthesised botanical presentation that has appeared in recent years. Fourteen volumes have already been published and others are in preparation. The publication of these fine works, each admirable and authoritative in its own sphere, is all the more praiseworthy in view of the difficulties of the present time. Dr. Verdoorn is to be congratulated on the success which has attended his enthusiastic editorship.

Nearly all the volumes published so far, including some translations, have been in English. Dr Verdoorn's remarks are of interest in this connection. " I feel ", he writes, " that the volumes of an international series of books, such as the ' New Series of Plant Science Books ', should as a rule be in English. An occasional volume in French, German or Spanish may be interspersed to emphasize the international character of the undertaking, but if it is to have a truly international distribution, a book should be in the dominant world language ". For this our " one-language scientists " should be humbly grateful.

EDITOR.

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F. C. BAWDEN : Plant Viruses and Virus Diseases (2nd entirely revised edition, 1943.) Chronica Botanica Co., Waltham, Mass. ; agents, Juta and Co., Johannesburg. $4.75.

Although virus diseases of plants have been recorded as far back as 1576, it is only during the present century that their increasing economic importance has compelled widespread attention. They include disorders of extremely varied types, ranging from severe stunting and necrosis, to a colour change so mild as to escape casual observation ; even further than this, viruses can in some cases be present within an apparently healthy plant and manifest themselves only when transferred to more reactive hosts. The losses they cause vary accordingly from a spectacular devastation of the crop to the opposite extreme of insidious but ever-increasing degeneration.

The study of these diseases constitutes the youngest branch of plant pathology, and their very name was unfamiliar to the majority of botanists even thirty years ago. Since viruses, by reason of the minute size of their particles, are invisible under the best combination of lenses, it was only by their ability to cause infective diseases that their existence was recognized. It was, therefore, inevitable that early investigators, groping amongst so-called "physiological diseases" should have based their studies on the visible symptoms produced in various host-plants by these unseen and unknown agents, and on the means of spread of the infection. During recent years, however, interest has been directed increasingly towards the isolation and examination of these agents themselves, whose obscure nature offered an intriguing problem to scientific workers hitherto unfamiliar with plant pathology. The chemical, physical and medical sciences no less than botany and entomology have given their disciples to this new study, and have contributed to the remarkable progress surveyed in the volume under review. The author is himself a leading investigator in the newer fields of virus research, and has rendered a great service in bringing within one volume a co-ordinated and critical review of a mass of records whose working technique and media of publication are equally beyond the usual range of many plant pathologists.

This book is essentially a progress report of a period of intense activity in virus research, and it cannot escape notice that, of the abundant publications quoted and discussed, relatively few are dated earlier than 1930. So active indeed is the growth of the subject that the second printing of this volume, made necessary by the destruction of the first in Holland, has provided opportunity for extensive revision in order to include advances made during the three intervening years.

Those who have followed the development of virus study will agree that outstanding general interest centres around the successful extraction of viruses from the plants in which they occur as obligate parasites. Much new ground has been broken since the first extracts were prepared, and heated debate has raged around the apparently crystalline proteins which have been isolated from diseased plants and which can reproduce the characteristic and specific disease symptoms in healthy plants. Tobacco Mosaic in particular has been subjected to intense study, and the new methods of purification and analysis have recently resulted in agreement that the nucleoprotein isolated is itself the essential constituent of the virus and not a contaminant or product of the isolation-processes. Several other distinct viruses have likewise been extracted and purified *in vitro* and have been found to consist solely of nucleoproteins related to that of tobacco mosaic.

While this suggests that the viruses are essentially nucleoproteins, it yet remains to be discovered whether they are present in this form within the plant tissues which they parasitise, and by what mechanism they multiply there. That their form may be modified within the living cell is indicated by the fact that the infectivity of virus preparations may disappear completely as result of treatments which leave their physical and serological characteristics unaltered.

In this connection particular interest attaches to the use of the electron microscope, which enables photographs to be made of the virus in the plant sap. The remarkable photographs reproduced in this volume are a forecast of further important progress in the new fields of microscopy whose technique is now being developed.

In contrast with these physico-chemical aspects, a notable advance of considerable practical importance is the identification of viruses by the use of their specific serological reactions. These differentiate between unrelated viruses and those strains which appear to arise from a parent form in a manner recalling mutation. Related strains can in turn be differentiated by the fact that a host-plant infected with one is immunised against others of its group. These two biological characteristics can be used to provide a basis for classification of viruses and the diseases which they produce. None of the proposed systems of grouping has received universal acceptance, and the existing nomenclature, originating from clinical studies of disease, is in a state of confusion. There is great need of a classification and system of naming which will be soundly based on the characteristics of the better-known viruses and will yet be capable of expansion to include those which still await full investigation.

E. S. Moore.

W. H. Schopfer : Plants and Vitamins, pp. xiv + 293 + 3 Plates. Waltham, Mass., U.S.A., The Chronica Botanica Co. ; Johannesburg, Juta & Co., 1943. $4.75.

A great deal of investigation has been carried out and much written on vitamins. Attention has been chiefly focussed on their biochemistry and on those aspects concerned with human nutrition. Although the plant is the chief source of vitamins and provitamins in animal nutrition, consideration of their possible importance to plants was neglected until the last decade. In the investigations conducted to establish the rôle of vitamins in plant metabolism, Prof. Schopfer has played a prominent part and he is especially known for his investigations on *Phycomyces Blakesleeanus*.

That *Plants and Vitamins* is a pioneer work in a new field made it desirable to outline the procedure for plant investigations and necessary to stress the difficulties of experimentation and interpretation, which afford many pitfalls for the unwary. This is especially true in relation to trace substances in the nutrient materials used (Chap. III). It also necessitated a consideration of the involved subject of classification, definition and synonymy of substances active in low concentrations (Chiefly Chap. IV). A consideration of terminology is all the more necessary since the current science of vitaminology has been mostly developed by animal physiologists.

The importance of vitamins to plants has been masked because green plants considered as entities are typically able to synthesise their own. An inability of a root to synthesise vitamin $B_1$ will not be evident since the deficiency will be supplied by the shoot. To elucidate the rôle of vitamins it was necessary to study the nutritional requirements of embryos with their cotyledons removed and of roots isolated from shoots. (Chap. VI).

There are plants, however, that are completely heterotrophic for one or more vitamins (or part of a vitamin). These are chiefly to be found among bacteria, flagellates and fungi. Heterotrophism in relation to a vitamin does not, however, correspond to taxonomic groupings since organisms as diverse as the rat and a yeast may require to be supplied with the same vitamin while two strains of a species may differ in their vitamin requirements (e.g. lactic bacteria. Chap. XIV). The importance which the author attaches to the investigation of auxo-heterotrophic plants in elucidating the fundamental vitamin requirements of plants is indicated by the fact that the greater part of the largest of the three sub-sections of the book is devoted to them. Part II contains a separate chapter on the rather special subject of yeast and bios (Chap. XII) and also separate chapters on the nitrogen fixing bacteria and the haemophilic organisms (Chaps. XV and XVI).

The third part of the book deals with the contributions of vitamin investigations to the understanding of a number of biological and agricultural problems. The presence of vitamins in soil and the effect of fertiliser treatment on the vitamin content of cultivated plants are considered (Chap. XXI). Growth factors in relation to sexuality are then discussed (Chap. XXII). The loss of the ability to synthesise one or more vitamins and the consequent need of an external source is considered in relation to symbiosis and parasitism (Chap. XXIII). Part III also contains a chapter (Chap. XXIV) devoted to a consideration of the suitability of micro-organisms as test objects for the various vitamins.

Biochemical no less than physiological aspects are dealt with ; the chief vitamins synthesised by plants (Chap. V), the important subject of their biosynthesis (Chaps. VIII and IX) and the action of vitamins as coenzymes (Chap. XVIII) are discussed. This tabulation should not give a false impression as biochemical aspects are fully dealt with throughout. This is especially seen in the frequent discussion of specificity of action of the various vitamins. The general approach to the subject, however, is physiological.

Other topics discussed include : growth factors in relation to plant tissue culture (Chap. VII) ; the action of animal hormones on plants ; and the occurrence of estrone in plants.

A reading of this book will show how uneven is our knowledge of the importance of the various vitamins in relation to plants. More is known concerning vitamin $B_1$ than of the others. Here and throughout, this book is not only useful as a review of present knowledge (although no claim is made for an exhaustive treatment) but also indicates gaps in our knowledge needing further investigations.

Prof. Schopfer in discussing the classification of active substances expresses the view that " general mode of action " is to be preferred as a criterion since it is a physiological one (p. 38). In his formal definition of a vitamin, however, he insists on exogenous origin : a vitamin " is required by an organism because the latter has lost the capacity to synthesise it " (p. 195). This would seem to be viewing the matter too exclusively from the angle of the food analyst. The term represents a group of substances which are physiologically necessary irrespective of whether an organism is able to synthesise them or not. A second comment relating to the proposed definition of a vitamin concerns the introduction of a " new criterion " : that a vitamin functions as a coenzyme or fragment of a coenzyme. The enzymatic nature of vitamin functioning is stressed throughout the book. This is in agreement with recent investigations but our knowledge is still incomplete. To include it as part of a theory or hypothesis would be appropriate but it seems somewhat out of place in a definition.

The English text contains a few ambiguous sentences. There are also a number of errors. Thus on p. 56 a table gives the ascorbic acid content of a number of plant organs as " mg/kg ". This should be " mg/gm " or " gm/kg ". Table IV (p. 68) shows that of the plant roots considered, flax has the greatest capacity for vitamin synthesis (which is correct) while the text states that this is true of the roots of the radish. On p. 120, substitution of $NH_2$ in the "second position" of the pyramidine nucleus should read "fourth position". Some of the statements relating to animals are rather too generalised in view of the author's claim to consider his subject from the wider aspect of general physiology.

These, however, are minor criticisms of a stimulating book packed with information which is well arranged, documented and lucidly expounded and contains many indications of directions in which further useful research could be carried out. Moreover, it is a book that will undoubtedly appeal to many workers in a number of scientific fields; to those working on vitamin problems in relation to plants it will be indispensable. WM. EDWYN ISAAC.

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G. ERDTMAN: An Introduction to Pollen Analysis, xvi + 240 pp. Price $5.00. Waltham, Mass., U.S.A., The Chronica Botanica Co.; Johannesburg, Juta & Co., Ltd., 1943.

The study of pollen from the point of view of the causation of allergic affections is of great practical significance. The present volume, giving an account of another aspect of the study, shows how it can lead—through paths of much obscurity and difficulty—to results of historical and theoretical interest. Pollen Analysis has given rise in the last few decades to a copious literature, cited by Dr. Erdtman with remarkable fullness, and to which he has himself largely contributed. From this has emerged a broader understanding of the various phases of plant migration and vegetational succession in the period succeeding the ice ages in the northern hemisphere.

The vast quantities of pollen liberated by anemophilous plants (including many dominant forest trees) combined with the relative imperishability of the walls of the grains has brought about their preservation in peat, recent alluvial deposits, etc. in great numbers. Their extraction and identification has become a fairly simple matter. Erdtman gives a valuable account of the methods employed in recovering pollen grains from such materials; and a great part of his book is a systematic description, fully illustrated, of the manifold types of grain produced by different families, genera and species. Erdtman gives estimates of the amount of pollen produced by several plants, the figures being fantastically enormous. A single stamen of Rye, for instance, produces 19,000 pollen grains: a single male cone of *Pinus nigra* produces 1,480,000 grains: a stand of *Pinus sylvestris* 100 m. square produces in 50 years 322,750,000,000 grains. *Calluna vulgaris* (the 'ling' heather) deposits annually 4,060 million grains on each square metre of soil beneath it.

From studies of the pollen grains embedded in deposits of peat, etc. it should be possible to arrive at a knowledge of the types of vegetation present in the neighbourhood during its period of formation. But hasty conclusions have to be avoided for several reasons, the chief of which is the great distance over which pollen grains may be transported by wind. Abundant pollen grains have been trapped on lightships at sea, by aeroplanes, on a North Atlantic voyage, and so on. A peat deposit from Greenland contained 355 coniferous pollen grains per gram dry weight, and identifications indicated a North American source for these—i.e. a distance travelled of 1,000 km. or more. This factor and others—such as the differences in rates of decay of different pollens, and the sinking and percolation of grains,—as well as problems such as suggested by the distribution of supposed pollen of Tilia, an entomophilous tree—have to be cautiously taken into account in basing historical conclusions on stratigraphy.

Vegetation problems are given the greatest prominence in this book, but short allusion is made to other topics in which pollen analysis is capable of giving interesting results. For instance, in archaeological studies it is sometimes possible to assign a stone implement to its horizon by the adhering pollen grains. The pollen contained in honey and drugs may give proof of adulteration—e.g. in a case of "Scotch Heather Honey" which was found to contain Leptospermum pollen.

A valuable chapter on the chemistry of peat, by the author's brother, Dr. H. Erdtman, is included.

Cordial thanks are due to the author for his admirable presentation of the actively growing subject of Pollen Analysis. For the way in which the great difficulties of language have been overcome, Dr. Erdtman and the editor, Dr. Frans Verdoorn, must share the gratitude of English readers.

R. H. COMPTON.

D. R. HOAGLAND: Lectures on the Inorganic Nutrition of Plants. (Prather Lectures.) 226 pages, including 28 plates. Waltham, Mass., The Chronica Botanica Co.; Johannesburg, Juta & Co., Ltd., 1944. $4.00.

As stated in the preface, *Inorganic Nutrition of Plants* is not a monograph. Prof. Hoagland, who is well known for his work in this field, places in broad perspective certain important aspects of this extensive subject. The scope is further limited in that the data used are chiefly those established in California. This and the relatively small compass of the book explain the absence of reference to the researches of some prominent investigators. Even with these self-imposed limitations, however, the book inevitably tends to be somewhat episodic in places. An attempt has been made to avoid this by following up a general introduction to a subject with a more detailed consideration of one facet. Thus a general discussion on micronutrients is followed by an account of investigations on zinc as illustrative of the problems and considerations involved.

The first lecture, besides being introductory, deals with the soil solution, including its relation to base exchange in soil colloids. Then follows an account of micronutrient elements essential to plant growth (Lect. 2). Hoagland regards copper and zinc as well as boron and manganese, as essential. A discussion on the absorption and accumulation of salts (Lect. 3) and of the factors governing their movement and distribution in the plant together with a consideration of the relation of water absorption to salt absorption (Lect. 4) follows. The importance of general metabolism and aerobic conditions for salt absorption, accumulation, and movement within the plant is stressed. Here as elsewhere, the value of researches using radioactive isotopes is shown. The technique and principles of artificial plant culture in liquid and pure sand media, and its rôle in plant nutrition investigations is examined in Lecture 5. In the following lecture various biochemical problems relating to salt absorption are dealt with. Selective ion absorption is considered in relation to organic acid synthesis and the absorption of nitrate and ammonium ions in relation to synthesis of amides. Related respiratory effects are considered. In the last lecture investigations relating to potassium are used to illustrate the complex of inter-related considerations (especially in regard to the soil) involved in studying plant nutrition. Many matters are dealt with in greater or lesser detail in addition to those mentioned above but an attempt has been made to indicate the general trend of the book.

Speculative aspects of the subject are considered but care is taken to distinguish between such speculation and generalisations based on adequate data. Frequently, however, the available data are inadequate and this inadequacy and the directions in which further investigation is necessary are emphasised. We are also given glimpses of work in progress.

The book has two outstanding merits. The need of regarding any function in relation to the entire metabolism of the plant in its setting of soil and climatic conditions is always borne in mind. Secondly, Prof. Hoagland's connection with agricultural science makes him alive to agricultural applications of researches on plant nutrition and to the contributions which field tests and observations can make to the interpretation of laboratory investigations. WM. EDWYN ISAAC.

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# A REVISION OF THE SOUTH AFRICAN SPECIES OF ORNITHOGALUM L.

By Frances M. Leighton.

## PART I.

The name Ornithogalum has its origin in antiquity. It was used by Theophrastus, the pupil of Aristotle, in his writings about 300 B.C. Pliny used the form Ornithogalen(1). Tournefort(2) cites Dioscorides lib. 2. cap. 174 as saying, " Ornithogalum in the language of the Greeks ὄρνισ—bird, and γάλα—milk. On the outside the flowers are certainly greenish, but when they are open, of a milk-white colour, the same colour which occurs in the wings of many birds."

Another suggestion as to the literal meaning of the name is that when the plants are in flower, the white dots scattered over the countryside resemble the droppings of birds. This view was held by some Old Testament scholars who maintain that "doves' dung" as mentioned in II Kings, chap. 6, verse 25, really refers to the bulbs of Ornithogalum. Credence may be given to this in view of the fact that the bulbs of *O. umbellatum L.* are still eaten in Palestine.(3)

The earliest reference to Ornithogalum which has been available for this work is in Clusius' Exoticarum, 1605. He refers here to a history of the genus which had appeared in one of his earlier books. In his Exoticarum he has two species of Ornithogalum namely, *O. neapolitanum* and *O. pyrenaeum.* Clusius mentions *O. aethiopicum* in his Curae Posteriores (1611) which in all probability refers to the bulbs he received from a Dutch ship that called at the Cape in 1605.(4)

There seems little doubt that the plant referred to on p. 138 of Parkinson's Paradisi in Sole (1629) as *O. aethiopicum* is the species which we now call *O. lacteum* Jacq. He says that " this plant was gathered by some Hollanders on the west side of the Cape of Good Hope ".

Lists of species of Ornithogalum appear in Chabraeius' work (1677)—12 species ; in Hermann's Hortus Lugduno-Batavi (1687)—13 species ;

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(1) Chabraeius : " Omnium Stirpium sciagraphia et icones " (1677).
(2) Tournefort : Institutiones Rei Herbariae (1700).
(3) Temple : Flowers and Trees of Palestine (1907).
(4) Curtis' Botanical Magazine, Vol. XXIX, 1164 (1809).

in Tournefort (1700)—60 species. Many of these species are no longer included in the genus. By the time the Species Plantarum was published Linnaeus had reduced the number of species to 12 of which to-day only 6 remain in the genus Ornithogalum. Linnaeus makes no reference to a plant from the Cape, but he may have included *O. thyrsoides* in his *O. arabicum.*

The bulbs of Ornithogalum were collected and taken to Europe by many of the early travellers. Ten Rhyne who visited the Cape in the 17th Century mentions them, apparently growing in great abundance on the flats.(5) Towards the end of the following century they were introduced into the gardens of Schönbrunn by Boos & Scholl. When the plants flowered they were described, and figured by Jacquin, several of them as new species.(6) Masson collected some of the bulbs which are mentioned in Aiton's Hortus Kewensis and the Botanical Magazine. Burchell was responsible for the introduction of several species and many of the collections mentioned by Baker in the Flora Capensis had been sent by Thomas Cooper.

## DISTRIBUTION OF THE GENUS.

The following figures have been obtained from the Index Kewensis and must be regarded as a very rough approximation since it was not possible to verify them from the literature available.

| | | *No. of species.* |
|---|---|---|
| 1. | South Africa (including South-West Africa) | 120 |
| 2. | Tropical Africa | 16 |
| 3. | North Africa | 9 |
| 4. | Balkans, South-east Europe and the Caucasus | 31 |
| 5. | Asia Minor and Persia | 33 |
| 6. | Italy, France and Spain | 25 |
| 7. | Northern Europe (Sweden, Great Britain, Germany) | 3 |
| 8. | South America | 4 |
| 9. | Orient | 2 |
| 10. | Madagascar | 1 |
| 11. | Mexico | 1 |

(N.B.—About 10 species are common to areas 4 and 5, and about 5 species are common to areas 4, 5 and 6.)

These figures indicate that the largest number of species is in Southern Africa, with a second centre of distribution in South-eastern Europe.

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(5) Ten Rhyne: Schedisma de Promontorio Bonae Spei (1686). Reprinted by the Van Riebeeck Society, Vol. 14, p. 106 (1933).

(6) Jacquin: Hortus Schoenbrunnensis (1797-1804).
Jacquin: Icones Plantarum Rariorum (1781-93).

The genus seems to flourish in a warm temperate climate, for it is but poorly represented in the colder countries of Europe and in the Tropics.

## ECONOMIC IMPORTANCE OF THE SOUTH AFRICAN SPECIES.

There has been considerable expansion in recent years of the export trade, to Great Britain and America, of inflorescences of *O. thyrsoides* and, to a lesser extent, *O. lacteum*. With the cut surface of the stalk waxed they can be carried very easily in the bud stage.

The leaves of *O. thyrsoides* have been known, when inadvertently mixed with fodder, to have caused the death of horses. It would seem that animals, grazing in pastures where the plants grow, avoid them and that a fairly large quantity of the leaves must be consumed before harmful effects are seen.(7)

## COMMON NAMES.

A number of common names for Ornithogalum occur in literature. In works written in English, the most usual is Star of Bethlehem, but Bird's Milk and Milk Stars also occur. German authors use the name Vogelmilch. In South Africa the species which are grown or used for household decoration are known as Chincherinchees. In Thunberg's time, the form of this was Tintirinties, a name given because of " the sound it produced when two stalks of it were rubbed against each other."(8) The original form of this was probably Tintiruintjes (uintjes = little onions.) In the Eastern part of the Cape Province the local species, both white and yellow, are often called " Cape Snowdrops ". This name is sometimes given in England to those which are exported.

Owing to war conditions this work on Ornithogalum must be regarded as tentative. It has been impossible for the author to visit Europe to study the types which are available or to consult certain works of the relevant literature. She has, however, had opportunities of examining more living specimens than any previous worker on the systematics of this genus.

She has also had facilities for studying the herbarium material of the South African Museum, the National Herbarium, Pretoria, and the Herbarium of the National Botanic Gardens, as well as that of the Bolus Herbarium, and to the directors of these institutions her thanks are due.

## TYPE OF THE GENUS.

International Bot. Congress, Cambridge, 1930. Report, p. 145.
" 377. Ornithogalum L. Sp. Pl. 306 ; Gen. Pl. ed. 5., 145.

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(7) Agric. Journ. C. of Good Hope, XXVIII, 165 (1906).
(8) Thunberg's Travels, Vol. I, p. 153.

*O. umbellatum* L., the best known of the 12 original species, half of which are now excluded from the genus. The species referred to in the citation in the Genera Plantarum (Ornithogalum Tournef. 203) is *O. arabicum* and this species is regarded as the type by Britton (Britt. and Brown, Illustr. Fl.)"

Tournefort's figure almost certainly represents *O. umbellatum* and Linnaeus' generic description seems to represent this species rather than *O. arabicum*. The observation at the end of the description on p. 145 seems to have been added to cover the inclusion of *O. arabicum* in the genus. The alternate filaments of *O. arabicum* can be described as trifid at the apex, but not those of *O. umbellatum*. Hence the author considers *O. umbellatum* and not *O. arabicum* to be the type of the genus and has given the explanation above in detail to show that there is no justification for the statement that Ornithogalum Tournef. 203 refers to *O. arabicum*.

## ORNITHOGALUM.

Linn. Sp. Pl. 306 (1753); Linn. Gen. Pl. ed. 5, 145 (1754); Ait. Hort. Kew. ed. (i) vol. I, 439 (1789); ed. (ii), vol. II, 256 (1811); Willd. Sp. Pl. Vol. II. 111. (1799); Linn. Syst. Veg. ed. XV. 348 (1797); Linn. Syst. Veg. Sprengel ed. XVI, vol. II. 29. (1825); Endl. Gen. Pl. 1132 (1836-40); Kunth Enum. IV. 349 (1843); Ardernia, Aspasia, Beryllis, Brizophila, Cathissa, Eustachys, Myanthe, Osmyne, Phaeocles, Taeniola, Urophyllon, Salisb. Gen. Plant. 33-35 (1866); Harvey Gen. of S.A. Plants 397 (1868); Bak. Journ. Linn. Soc. XIII. 257 (1873); Benth. and Hook.f. Gen. Plant III. 815 (1880); Bak. in Fl. Cap. VI. 494 (1896); Bak. in Flor. Trop. Afr. VII. 544 (1898); Phillips Gen. S.A. Fl. Pl. 153 (1926); Hutch. Fam. Flow. Pl. II. 100 (1934); Krause, Engl. and Prantl Pflanz. Fam. (1930).

*Bulb* tunicated. *Leaves* radical. *Inflorescence* a raceme, bracts scarious, persistent. *Perianth* polyphyllous, persistent, white, yellow, orange, khaki or cinnamon-coloured, sometimes with a longitudinal median green or brownish stripe down each segment, the three segments of the inner perianth whorl usually longer and broader than those of the outer. *Stamens* 6, in two whorls, sometimes sub-equal, usually the filaments of the outer whorl narrower than those of the inner which may be widely expanded especially near the base.(9) *Anthers* versatile, dehiscence introrse. *Ovary* sessile, trilocular, ovules many in each chamber. *Stigma* trilobed. *Capsule* with loculicidal dehiscence. *Seeds* angled or pyriform, black.

(9) Kerner describes these out-growths of the filaments as stipules.

## KEY TO THE SPECIES.

Style well developed.
Filaments of both outer and inner whorls widely expanded.
Style under 2 mm. long. Perianth usually orange or yellow rarely white.
Filaments of outer and inner whorls sub-equal or with similar expansions.
Flowers usually 3 cm. or more in diam., seeds with papillose testa .. .. .. .. .. 1 miniatum.
Flowers usually under 3 cm. in diam., seeds with granulated testa .. .. .. .. 2 Fergusoniae.
Filaments of outer whorl only slightly expanded, never with winglike out-growths .. .. .. 3 flavissimum.
Style 2 mm. or more in length. Perianth usually white, rarely yellow.
Flowers usually yellow, rarely white .. .. .. 4 Brownleei.
Flowers white or cream.
Filaments narrowly petaloid—without angular expansions .. .. .. .. .. .. 5 subcoriaceum.
Filaments with angular or lobed expansions.
Outer filaments with erect apical processes on basal expansion .. .. .. .. 6 ceresianum.
Outer filaments with lateral or infolding processes on basal expansions.
Perianth segments long, acute .. .. .. 7 Hermannii.
Perianth segments broad, obtuse or sub-acute
Filaments white or cream .. .. .. 8 alticolum.
Filaments with the same colouring as the bases of the perianth segments.
Outer filaments only slightly expanded in the lower half .. .. .. .. 9 Leipoldtii.
Outer filaments with wing-like expansions in the lower half .. .. .. 10 Pillansii.
Filaments of outer whorl simple.
Filaments sub-equal .. .. .. .. .. 12 lacteum.
Filaments of outer and inner whorls distinct.
Flowers white or cream, bases of segments and ovary greenish or greyish .. .. .. .. 11 thyrsoides.
Flowers pure white, ovary clear yellow or yellow green.
Bulbs with blackish outer tunics, leaves glaucous, ovary tapering.
Leaf margins densely ciliate .. .. .. 15 fimbrimarginatum.
Leaf margins minutely ciliate or entire .. .. 14 pruinosum.
Bulbs greyish or white, leaves green, ovary truncate 13 conicum.
Style almost absent.
Leaves linear, subterete.
Filaments twice as long as broad.
Inflorescence densely many flowered .. .. .. 16 multifolium.
Inflorescence lax few flowered .. .. .. .. 17 ranunculoides.
Filaments more than twice as long as broad .. .. 18 rupestre.
Leave lanceolate or ovate, flat .. .. .. .. 19 maculatum.

The figures, which are all natural size, show in each case an analysis of the floral parts in the following order :—outer and inner perianth segments, outer and inner stamens, gynaeceum, and should be used to clarify some of the distinctions used in the key.

1. **O. miniatum** Jacq. Coll. III. 233; Ic. II. 438. *O. flavescens* Jacq. Coll. III. 233; Ic. 437. *O. aureum* Curt. Bot. Mag. 190; Kunth Enum. IV. 352 (in part); Willd. Sp. Pl. II. 124 (excl. *O. flavissimum*);

Marloth Fl. S. Af. IV. Pl. 28. p. 106. *O. thyrsoides* var. *flavescens* Lindl. Bot. Reg. 305 ; Kunth Enum. 353 ; (Bak.) Fl. Cap. VI. 499. *O thyrsoides* var. *miniatum* Bak. ibid. 500 ; *O. miniatum* Kunth IV. 352. *Aspasia flavescens* Salisb. Gen. 34 ; *A. aureum* ibid. 34. Plants 10—35 cm. high. *Bulb* ovoid or globose 1—2 cm. diam. *Leaves* 3—5, lanceolate or lanceolate-ovate, 4—10 cm. long, 1—2 cm. broad, apices acute or obtuse, margins densely ciliate. *Inflorescence* few to many-flowered, bracts conspicuous, often as long as the pedicels ; pedicels 2—5 cm. long. *Perianth* yellow, orange, orange-red, khaki-coloured or white, segments sometimes spreading widely but the flower more often cup-shaped, 3—4 cm. diam. *Perianth segments,* ovate 15—20 mm. long, 9—13 mm. broad, apices obtuse or subacute. *Stamens* less than half the length of the perianth segments, filaments all expanded into winglike out-growths in the lower half, three inner more widely expanded than the three outer, but often the two whorls, sub-equal. *Ovary* ovoid or globose, style very short, stigma large with prominent decurrent lobes. *Seeds* black with blunt papillae often short and almost knoblike.

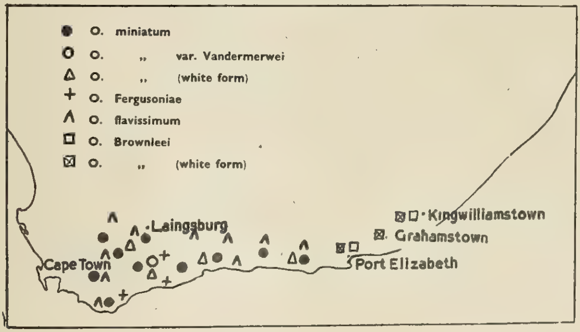
Widely distributed in the drier areas of the South-Western Cape and extends along the edge of the Karoo as far as Uniondale, and in the coastal area to Humansdorp. Flowering Sept.-Dec.

*Hab.* Cape Province : Caledon Div. : e hort *Stanford* in Bolus Herb. 22833; Caledon, *van der Merwe* in Nat. Herb. s.n.; Villiersdorp, *Schlechter* 9369 ; Genadendal *Prior* s.n. ; *Schlechter* 9797 ; *Rogers* 29014. Bredasdorp Div. : Zoetendals Vlei, *Esterhuysen* 5223. Ceres Div. : Karoopoort, *Marloth* 6589, 6590. Tulbagh Div. : Tulbagh, *Stell. Univ. Gdns.* s.n. ; *Marloth* 9572. Worcester Div. : Rabiesberg, *Esterhuysen* in Bolus Herb. 22834 ; Touws River, *Hurling and Neil* in Bolus Herb. 22839 ; Worcester, *du Plessis* in Bolus Herb. 22840; Hex River Valley, *Marloth* 1979 ; Touws River, *Lewis and Dymond* in Nat. *Bot. Gdns.* 1953/33. Laingsburg Div. : Tweedside, *Lewis* in Nat. Bot. Gdns. 2696/32 ; Lammerfontein, *Wilmot* 2 (Nat. Herb.). Robertson Div. : *Hurling and Neil* in Bolus Herb. 22841 ; Between McGregor and Storms Vlei, *Esterhuysen* 5222 ; Robertson Karoo, *Esterhuysen* in Bolus Herb. 22154. Swellendam Div. : Swellendam, *Leighton* in Bolus Herb. 22835 ; *Hurling and Neil* in Bolus Herb. 22836 ; Swellendam, *Galpin* 4768 ; *Hurling and Neil* in Nat. Bot. Gdns. 1956/30 ; Barrydale, *Galpin* 4769 ; Buffelsjagts Rivier, *Zeyher* 4201 ; Zondereinde Riv., *Zeyher* 4201B ; Tradouw Pass, *Walgate* in Bolus Herb. 22850. Montagu Div. : 25 miles E. of Montagu, *Martley* in Bolus Herb. 22838. Riversdale Div. : near Vet River, *Muir* 2808. Riversdale, *Ferguson* in Bolus Herb. 19983. Knysna Div. : Knysna, *Browne* in Nat. Bot. Gdns. 123/37 ; Woodbourne, *Laughton* in Bolus Herb. 22832. *Duthie* 1148 ; Forest Hall, *Gillett* 2232. Zuurberg, Koratora *Keet* 1003. Noetzie, *Compton* 24/34; Forest Hall, *Fourcade* 4175; Knysna, *Davis* in Nat. Bot. Gdns. 1537/31; Knysna Heads, *Fourcade* 1080. George Div.: George, *Fuller* in Bolus Herb. 22849 and 22702; *Marloth* 8329; Kaaimans Gat, *Wilman* in Bolus Herb. 22683. Hoogekraal Riv., *Fourcade* 1522; Zwart River *Fourcade* 1575. Prince Albert Div.: Meirings Poort, *Thorns* in Herb. Nat. Bot. Gns. s.n.; Uniondale Div.: Prince Alfred's Pass, *Fourcade* 5866; Hot Springs, *Fourcade* 5425; Laudina, *Esterhuysen* 6521. Humansdorp Div.: Hills near Humansdorp, *Fourcade* 1763; Bok Kraal, *Fourcade* 5159A.

[Fig. 1. Map I.]

Var. **Vandermerwei** (Barnes) Leighton var. nov.

*O. Vandermerwei* Barnes, S.A. Gardening Vol. XXI, p. 14 (Jan. 1931).



Map I.

*Perianth* khaki-coloured with darker centres. *Stamens* shorter and more widely expanded than in the typical.

*Hab.* Swellendam Div.: near Bonnievale, *Van der Merwe* in Nat. Bot. Gdns. 1814/29, *Hurling and Neil* in Bolus Herb. 22837, *Marloth* 6293, *Leighton* in Bolus Herb. 21185; Between Swellendam and Bredasdorp, *Muir* 4989; Swellendam, *Marloth* 8633. Montagu Div.: Ashton, *Hill* in Nat. Bot. Gdns. 1768/29. Robertson Div.: Between McGregor and Storms Vlei, *Esterhuysen* 2941; Between Worcester and Robertson, *Hurling and Neil* in Bolus Herb. 19296; Robertson, *Marloth* 7746.

[Fig. 1A. Map I.]

2. **O. Fergusoniae** L. Bolus. S.A. Gardening Vol. XXII, 57 (Feb. 1932).

Plants 15—30 cm. high. *Bulb* 2—3 cm. diam. *Leaves* 3—6, linear or lanceolate, 7—13 cm. long, 10—15 mm. wide, margins ciliate. *Inflorescence* few to many-flowered, pedicels ascending or erect. *Perianth* yellow above, green on the underside, sometimes white, segments obtuse or sub-acute, 10—15 mm. long, 6—7 mm. broad. *Stamens* short, filaments all expanded, three inner filaments unusually broad relatively to their length. *Ovary* ovoid, style short, stigma large with decurrent papillose lobes. *Seeds* pyriform, surface granulated. Flowering Oct.—Dec.

*Hab.* Riversdale Div.: near Still Bay, *Ferguson* in Nat. Bot. Gdns. 45/31; Hills near Kaffir Kuils River, *Muir* 2755; near Riversdale, *Muir* 2988 and 1164; *Muir* in Herb. Galpin 5400 (white form); *Muir* 3786 (white form). Swellendam Div.: near Bonnievale, *Hurling* and *Neil* in Bolus Herb. 19338, 22854. Bredasdorp Div.: Bredasdorp, *Breach* in Bolus Herb. 22855.

[Fig. 2. Map I.].

This may prove to be only a variety of *O. miniatum* Jacq., but has been kept apart by virtue of its smaller flowers, the broadness of the inner stamens and the distinct granulation of the testa.

3. **O. flavissimum** Jacq. Ic. II 436. Coll. Suppl. V, 75. O. aureum Red. Lil. 439 (excl. A, B, C, in citation); Kunth Enum. IV, 352 (in part) non Curtis.

Plants 10—40 cm. usually 20—30 cm. high. *Bulb* globose or depresso-globose, 1—2 cm. diam., often with a dark brown leathery tunic. *Leaves* 3—6, varying from lanceolate forms 20 cm. long, 2 cm. broad to long-ovate forms 5 cm. long, 15 mm. broad, margins densely ciliate, apices acute to obtuse. *Inflorescence* few- to many-flowered, often rather lax, rarely dense, bracts usually a little shorter than the pedicels. *Perianth* yellow or orange, segments spreading, flowers rarely cup-shaped 2—4 cm. diam., segments ovate, acute or sub-acute, 1—2 cm. long, 5—10 mm. broad. *Stamens* less than half the length of the perianth, both outer and inner filaments expanded in the lower half, outer stamens much less than the inner and the expansions not in the form of wing-like outgrowths such as those of the inner stamens. *Ovary* ovoid or somewhat globose, style short, stigma large with prominent decurrent lobes. *Seeds* echinate or sometimes with blunt papillae.

Flowering Sept.—Nov.

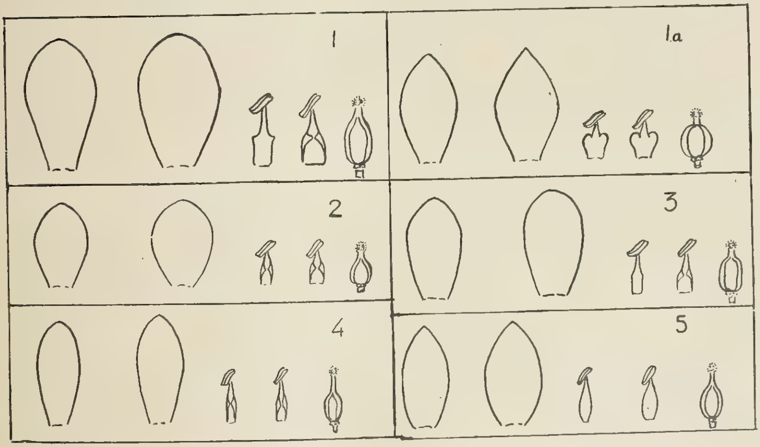
Distribution very similar to that of *O. miniatum* Jacq.

*Hab.* Cape Province. Bredasdorp Div.: Kathoek, *Pillans* 9370. Worcester Div.: Hex River Valley near De Doorns, *Bolus* 22830; Bottom of Hex River Pass, *Lavis* in Bolus Herb. 22831; Hex River, *Marloth* 6290; Bonteberg. *Esterhuysen* 3871, *Compton* 9967. Tulbagh Div.: Tulbagh, *Guthrie* 2768; Artois, *Compton* 11680, *Esterhuysen* 6079; Tulbagh, *Peers* in Bolus Herb. 22852, *MacOwan*, Herb. Norm. 505. Ceres Div.: Hottentots Kloof, *Compton* 12058. Laingsburg Div.: Tweedside, *Lewis* in Bolus Herb. 22829; *Barker* in Bolus Herb. 20638;

Constable, *Compton* 9738 ; Pieter Meintjies, *Marloth* 10781 ; Bantams Karoo, *Compton* 12151. Ladismith Div. : *Gillett* 1914. Oudtshoorn Div. : Road to Cango Caves, *Barker* 87 ; Cango Valley, *Marloth* 12126. Uniondale Div. : Haarlem, *Esterhuysen* 6932 ; Lauterwater, *Compton* 5251. Humansdorp Div. : Klipvlei, *Esterhuysen* in Bolus Herb. 22797 ; Assegai Bosch, *Esterhuysen* 7121.

[Fig. 3. Map I.].

*O. flavissimum* and *O. miniatum* have both been upheld although the author has grave doubts as to whether they are really distinct species. The extreme forms of these species are quite distinct and it seemed wiser to keep them apart until further investigation, perhaps cytological studies, may clarify the position of the many intermediate forms. The author has omitted from the citation several figures and references which do not show clearly, or are vague, in their description of the filaments, since this seems to be the only character on which the separation can be made.



1. O. miniatum. 1a. O. miniatum var. Vandermerwei. 2. O. Fergusoniae. 3. O. flavissimum. 4. O. Brownleei. 5. O. subcoriaceum.

4. O. **Brownleei** Leighton. S.A. Gardening Vol. XXIII, 62. (March 1933).

Plant 20—40 cm. high. *Bulb* globose 1—2 cm. diam. *Leaves* 4—6, lanceolate to ovate with obtuse apex, 7—14 cm. long, 1—4 cm. broad, margins ciliate. *Inflorescence* lax, 7—20-flowered, bracts usually shorter than or sometimes as long as the pedicels : pedicels up to 35 mm. long. *Perianth* yellow or white, segments spreading widely, usually sweetly scented ; segments obtuse rarely sub-acute, 12—17 mm. long, 7—10 mm. broad. *Stamens* less than half as long as the perianth segments, filaments all expanded into winglike outgrowths, three inner more widely than the three outer. *Ovary* ovoid 5—6 mm. high, style distinct 2—3 mm. long, stigma lobes decurrent, papillose.

Flowering Oct.—Nov.

*Hab.* King Wms. Town Div. : Middle Drift, *Brownlee* in Bolus Herb. 20366, *Crampton* 101 ; *Brownlee* in Bolus Herb. 22714 (white form). Peddie Div. : *Village Management Board* in Bolus Herb. 22842. Albany Div. : Carlisle Bridge, *Daly* 125 and 126 (white form) ; Grahamstown, *Galpin* 311. Uitenhage Div. : van Staden's Pass, *James* in Bolus Herb. 22844 ; Zuurberg—Uitenhage Road *G. G. Smith* 2869 ; Uitenhage, *E. & Z.* (S.A. Mus. 23330), *Jordan* 81 (Alb. Mus. Herb.).

[Fig. 4. Map I.]

5. **O. subcoriaceum** L. Bolus S.A. Gardening XXIV. 50. (Feb. 1934). Plants up to 20 cm. high, usually less. *Bulb* globose, 10—15 mm. diam. with tough, leathery outer tunics. *Leaves* 2—4, synanthous, erect or spreading, tough, ovato-lanceolate to ovate, rarely lanceolate, 3—8 cm. long 1—3 cm. broad, apices obtuse or sub-acute, margins conspicuous, densely ciliate. *Inflorescence* usually just overtopping the leaves, but often taller in cultivation, few or many flowered, corymbose, bracts ovate, apex attenuate, margins minutely ciliate, near the apex at least. *Perianth* white, segments ovate with a faint green median stripe on the under side which disappears as the flower ages, 12—15 mm. long, 7—10 mm. broad. *Stamens* about half as long as the perianth, filaments all expanded gradually from apex to base, 3 inner slightly broader than the three outer. *Ovary* obovate, style 2—3 mm. long, stigma with conspicuous decurrent lobes. *Seeds* tuberculate.

Flowering Sept.—Oct.

*Hab.* Cape Province. Calvinia Div. : near Nieuwoudtville, *L. Bolus* in Bolus Herb. 20090. Clanwilliam Div. : Pakhuis, *Salter* 2779 ; *Esterhuysen* 4390 ; Brandewyns Rivier, *Lewis* in Bolus Herb. 22853 ; Elandskloof, *Lewis* in Bolus Herb. 22088. Cederberg, *Lamb* in Nat. Bot. Gdns. 1619/30 ; Middelberg, Cederberg, *Esterhuysen* 7278; Cederberg, *Thode* A2096.

[Fig. 5. Map IV.].

6. **O. ceresianum** Leighton Journ. Bot. LXXI. 72. (1933).

Plants 20—30 cm. or more high. *Bulb* globose, 16—20 mm. diam. *Leaves* 4—6, often persisting at the flowering time, linear, coriaceous, subconvolute, 10—25 cm. long, 15—30 mm. broad, apices attenuate. *Inflorescence* many-flowered, subpyramidal ; bracts shorter than the pedicels, long-cuspidate from a broad base ; pedicels spreading, up to 4 cm. long. *Perianth* cream with the lower third of each segment greenish black, segments obovate or oblong, acuminate, up to 2 cm. long and 10—11 mm. broad. *Stamens* less than half as long as the perianth segments, filaments all markedly expanded, both outer and inner whorls having winglike upgrowths at the apices of the expansions, the outer somewhat narrower than the inner. *Ovary* ovoid or slightly orbicular, truncate at the apex, dark green in colour, glabrous, style 2 mm. long, stigma lobes decurrent.

Flowering Oct.—Nov.

*Hab.* Cape Province. Ceres Div.: near Ceres, *Cook* in Nat. Bot. Gdns. 1756/25; Warm Bokkeveld, *Basson* in Bolus Herb. 22845; Laken Vlei, *Compton* 12082; Ceres, *Goatcher* in Bolus Herb. 13726, *Heatlie* in Nat. Bot. Gdns. 3710/15, *Rogers* 28224, *Marloth* 7239, *MacOwan* 2990 (S.A. Mus. 23332).

[Fig. 6. Map II.].

7. **O. Hermannii** Leighton S.A. Gardening Vol. XXIII. 62. (1933).

Plants 20—50 cm. high. *Bulb* globose 16—20 cm. diam. *Leaves* 5—8, often persisting at the flowering period, linear, 10—25 cm. long, 15—30 mm. broad, apices acute, margins ciliate. *Inflorescence* many-flowered, subpyramidal, rather lax, bracts acuminate, shorter than the pedicels, pedicels up to 5 cm. long. *Perianth* cream, segments acute, rarely spreading, 2—3 cm. long, 8—12 mm. broad. *Stamens* erect, less than half the length of the perianth segments, 3 outer filaments slightly expanded in the lower half, 3 inner widely expanded and lobed at the apex. *Ovary* obovoid, style slender, 3—4 mm. long, stigma small.

Flowering Sept.—Oct.

*Hab.* Cape Province. Clanwilliam Div.: Citrusdal, *Salter* 2806, 3870, in Nat. Bot. Gdns. 1038/33, *Mathews* in Nat. Bot. Gdns. 2100/29, *Pillans* 9851, 9850.

[Fig. 7. Map II.].

8. **O. alticolum** Leighton sp. nov.

Plantae alt. ad 60 cm. *Folia* lanceolata, long. ad 15 cm., lat. ad 2 cm. marginibus ciliatis. *Inflorescentia* alta, corymbosa, bracteis conspicuis. *Perianthium* album, segmentis obtusis vel subacutis, basibus viridibus vel brunneis, long. 12—20 mm., lat. 8—12 mm. *Stamina* omnia basi late expansa, subaequalia. *Ovarium* globosum. *Stylus* brevis, stigma lobis decurrentibus.

*Hab.* Cape Province. Paarl Div.: Du Toit's Kloof. *Pillans* 8384. (*Type*). Ceres Div.: Witsenberg. *Pillans* 9566. Caledon Div.: Genadendal, *L. Bolus* in Nat. Bot. Gdns. 410/33. Worcester Div.: Worcester, *T. Cooper* 1690.

Plants up to 60 cm. high. *Leaves* lanceolate, up to 15 cm. long, 2 cm.

broad, margins ciliate. *Inflorescence* tall, with a relatively short dense, corymbose head, bracts conspicuous. *Perianth* white, segments with a greenish or brown base, obtuse, rarely subacute, 12—20 mm. long, 8—12 mm. broad. *Filaments* all expanded in the lower half, with wing-like outgrowths. *Ovary* globose, style short, stigma large.

Flowering Sept.—Nov.

[Fig. 8. Map II.].

Forma β. Inflorescence rather long, leaves broad, arranged in a rosette on the ground.

*Hab.* Caledon Div.: above Houw Hoek, *M. C. Gillett* 4289.

[Fig. 8A. Map II.].

Forma γ. Inflorescence dense, composed of smaller flowers, filaments of the outer whorl of stamens only slightly expanded.

*Hab.* Caledon Div.: Hermanus, *Pells* in Bolus Herb. 22706; *Marloth* s. n. in Nat. Herb.

[Fig. 8B. Map II.].

*O. alticolum* differs from the white forms of *O. miniatum* chiefly in the length of the style. The plants are usually very much taller than those of *O. miniatum.*

9. **O. Leipoldtii** L. Bolus Journ. Bot. LXXI. 71 (1933). *O. revolutum* Jacq. Gawl. in Bot. Mag. 653. Plants up to 56 cm. high. *Bulb* globose or ovoid, 15—25 mm. diam. with hard, brownish outer tunics. *Leaves* 4—6, erect, clasping the base, 10—25 cm. long, 15—40 mm. broad, margins hyaline, with minute ciliations in forma γ, apices acute or sub-obtuse. *Peduncle* slender. *Inflorescence* few- to many-flowered, dense, bracts membranous, acuminate from a broad base, equal to or exceeding the pedicels. *Pedicels* ascending 15—22 mm. long. *Perianth* white, cup-like, segments, usually with a yellowish or golden brown base which fades to pure white as the flower ages, rotundate, 15—20 mm. long, 10—15 mm. broad. *Stamens* about half as long as the perianth segments, filaments grey-green, white at the apices and bases, 3 outer slightly expanded, 3 inner widely expanded with the wing-like apical outgrowths incurved. *Ovary* globose or somewhat ovoid, style 4 mm. long, stigma papillose, lobes decurrent. *Seeds* black, echinate.

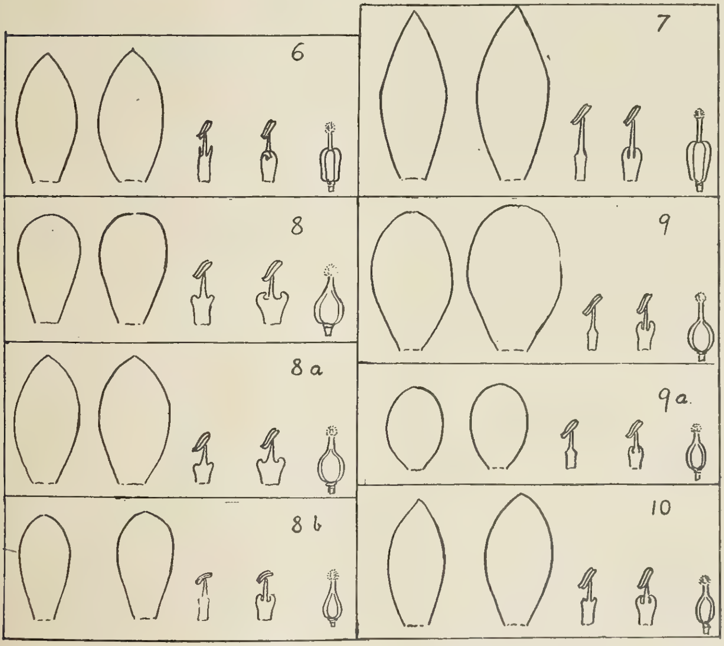
Flowering Oct.—Nov.

*Hab.* Cape Province. Clanwilliam Div.: Olifants River Valley near the weir, *Leipoldt* in Bolus Herb. 19941, *Mathews* in Nat. Bot. Gdns. 1892/31; Warmbaths, *L. Bolus* in Bolus Herb. 20349; Pakhuis, *Leighton* in Nat. Bot. Gdns. 1503/33; Nieuwoudt Pass, *Esterhuysen* 7162, *Compton* in Nat. Bot. Gdns. 3171/34, *Esterhuysen* in Nat. Bot. Gdns. 7/42; Middelberg, Cederberg, *Esterhuysen* 7132; between junction of Groot Rivier road and Elands Kloof, *Leipoldt* in Bolus Herb. 22075;

eastern ascent of Grey's Pass, *Pillans* 8665 ; nek on S. side, Grasruggens Mt., *Pillans* 8666 ; between Paleisheuvel and Sandberg, *Esterhuysen* in Nat. Bot. Gdns. 2372/34. Piquetberg Div. : E. base of the Piquetberg, *Pillans* 7986 ; Porterville, *Martley* in Bolus Herb. 22812.

Forma β differing from the type in having shorter leaves, corymbose inflorescences, and smaller flowers.

*Hab.* Piquetberg Div. : near Piquetberg, *Bolus* 13656, *Salter* 2718.



6. O. ceresianum. 7. O. Hermannii. 8. O. alticolum. 8a. O. alticolum forma. β. 8b. O. alticolum forma γ. 9. O. Leipoldtii. 9a. O. Leipoldtii forma β. 10. O. Pillansii.

Malmesbury Div. : Koppies between Malmesbury and Hopefield, *Mathews* in Bolus Herb. 22704. Paarl Div. : outskirts of Wellington, *Leighton* in Bolus Herb. 22703.

[Fig. 9A. Map II.].

Forma γ differing from forma β only in having taller inflorescences and minute ciliations on the leaf margins.

*Hab.* Ceres Div. : Mitchell's Pass, *Cook* in Nat. Bot. Gdns. 1766/25 ;

Ceres, *Goatcher* in Bolus Herb. 22157, *Dymond* in Nat. Bot. Gdns. 1942/33, *Davis* in Nat. Bot. Gdns. 2531/31, *Marloth* 6390.

[Map II.].

The plant figured in Loddiges' Botanical Cabinet 1159 as *O. lacteum* belongs to this group but the staminal structure is not sufficiently clearly shown to warrant its inclusion in any of the species described here. The illustration in the Botanical Register 315 of *O. revolutum* is possibly *O. Pillansii*.

It is possible that *O. Leipoldtii* is the same as *O. revolutum* Jacq. Hort. Schoen. I 89, but, if this is the case, Jacquin's figure is poor and his description unsatisfactory. From his figure it is obvious that the plant had almost finished flowering and had been in water for some time. As this has not been matched with a specimen it has been rejected.

In Saunder's Refugium Botanicum I t. 20 the plant depicted as *O. thyrsoides* is one which appears to be closely related to *O. Leipoldtii* and *O. Pillansii* but differs from the former in respect of the character and density of the inflorescence, and from the latter in the width of the outer stamens.

10. **O. Pillansii** Leighton sp. nov.

Plantae alt. ad 50 cm. *Bulbus* oblongo-globosus, diam. 15—20 mm., tunicis duris brunneis. *Folia* 4—6, lanceolata, apicibus obtusiusculis, marginibus ciliatis. *Inflorescentia* gracilis, pedicellis patentibus. *Perianthium* niveum, segmentis latis, apicibus obtusis, vel subacutis; basibus aureo-brunneis vel viride-brunneis. *Filamenta* aureo-brunnea, basibus et apicibus albis, tria exteriora basi leviter ampliata, tria interiora basi per 3 mm. ampliata, apicibus alatis. *Ovarium* ovoideum, velutinum; stylus brevis; stigma lobis decurrentibus. *Semina* atra, spinis brevibus.

*Hab.* Cape Province. Piquetberg Div.: near Het Kruis, *Leighton* 134 (*Type*), *Barker* 2581; Boesmans Kloof Rivier, *Leighton* 136; Rooikransberg, *Pillans* 8087; Karroid hill S. end of Kapiteins Kloof, *Pillans* 8115, Malmesbury Div.: Riebeek Kasteel, *Salter* 1791. Clanwilliam Div.: Elandsfontein, *Pillans* 9848, 9186.

Plants 25—50 cm. high. *Bulb* oblong-globose, 15—20 cm. diam., with hard brownish outer tunics. *Leaves* 4—6, lanceolate 5—15 cm. long, 10—15 mm. broad, with densely ciliate margins, apices somewhat obtuse. *Peduncle* slender, few- to many-flowered, pedicels spreading, 20—45 mm. long at flowering time elongating as the fruit ripens. *Perianth* white, segments with a deep golden brown or greenish brown base the colour of which persists with age, broad, obtuse, sometimes sub-acute, 12—20 mm. long, 9—15 mm. broad. *Stamens* rather less than half as long as the perianth, segments filaments all expanded, golden-brown, white at the base and apex, the outer filaments with narrow wing-like expansions, the inner with wide incurving expansions in the lower half. *Ovary* ovoid, velvetty, blue-grey, style short, stigma with well-marked decurrent lobes. *Seeds* rugose with blunt papillae on the angles.

Flowering Oct.

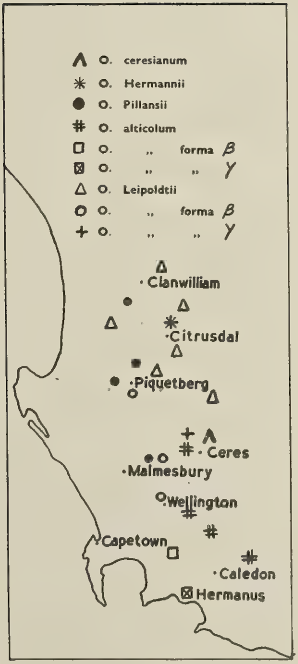
*O. Pillansii* differs from *O. Leipoldtii* in the following respects :—

1. The outer stamens are more widely expanded.
2. The dark colouration in the centre of the flower does not fade.
3. The seeds are rugose with papillae on the angles whereas those of *O. Leipoldtii* are echinate.

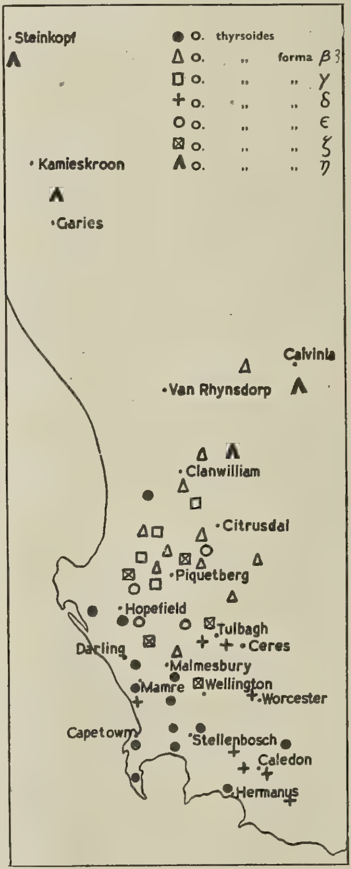
[Fig. 10. Map II.]

11. **O. thyrsoides** Jacq. Hort. Vind. III 17 t. 28 ; Thunb. Prodr. 62 ; Thunb. Fl. Cap. edit. Schultes 315 ; Ait. Hort. Kew. edit. 1. Vol. I, 442 ; ibid edit. 2. Vol. II, 261 ; Kunth Enum. IV, 353 ; Bot. Mag. 1164 ; Annales Sc. Nat. Paris XXIII, 23—24 t. 1 ; Edmonds and Marloth, El. Bot. S.A. 178 ; Henslow. S.A. Fl. Pl. 267 ; Agric. Journ. C. of Good Hope XXVIII 165 ; Willd. Sp. Pl. II 124, excl. vars. ; Bak. Fl. Cap. VI 499 (synonymy in part and excl. vars.) *O. coarctatum* Jacq. Ic. II. 435. *O. bicolor* Haw. Misc. 175 : *Aspasia thyrsoides* Salisb. Gen. 34.

Plants up to 60 cm. usually 20—40 cm. high. *Bulb* globose or depresso-globose, 15—25 mm. in diam., covered with whitish or grey papery tunics. *Leaves* 3—6, linear or lanceolate, 10—40 cm. long, 1—3 cm. broad, apices acute, margins hyaline, usually ciliate, rarely entire, withering or completely withered at the flowering period, rarely synanthous. *Inflorescence* usually corymbose or subcorymbose rarely long and spicate, few- or many-flowered, flowering part 5—20 cm., usually less than 10 cm. in length. *Bracts* ovate or acuminate from a broad base. *Pedicels* 2—4 cm. long when the earlier flowers open, the lower pedicels increasing to twice their original length as the flowers fade and the fruits develop, giving a corymbose appearance to the inflorescence. *Perianth* usually spreading, segments never quite flat or reflexed except under unnatural conditions (e.g. inflorescences kept long in water) ; cream or white, usually brownish or greyish-green near the bases of the segments, which often fades to pure white or cream as the flower ages, open flowers 25—50 mm. in diam. *Perianth-segments* long-ovate about twice as long as broad, three inner usually somewhat longer and broader than the three outer apices acute or sub-acute. *Stamens* about half as long as the perianth-segments, sometimes less, three outer simple, subulate, only slightly broader at the base than at the apex, three inner broadly and abruptly expanded in the lower half : these expansions have wing-like outgrowths at their apices which curve inwards towards the ovary. *Ovary* ovoid, brown or greenish-grey, style distinct, about half as long as the ovary, usually whitish in the upper half: stigma with three decurrent papillose lobes: ovary, style and stigma together equal to, or a little shorter than, the stamens. *Capsules* 8—20 mm. long when ripe, containing many black, angled seeds with verrucose or rugose surfaces and dentate, or rarely, smooth margins.



MAP II.



MAP III.

Grows freely on hills, lower slopes of the mountains and on the flats, less common on the upper slopes of the mountains. Flowering Oct.—Nov. on lower slopes and flats, Dec.—Feb. on higher slopes and in ravines.

*Hab.* Cape Province. Cape Peninsula: Above Kirstenbosch, *Bolus* 4919; Between Fountain and Grotto Ravines, *Pillans* 4905; Skelet on

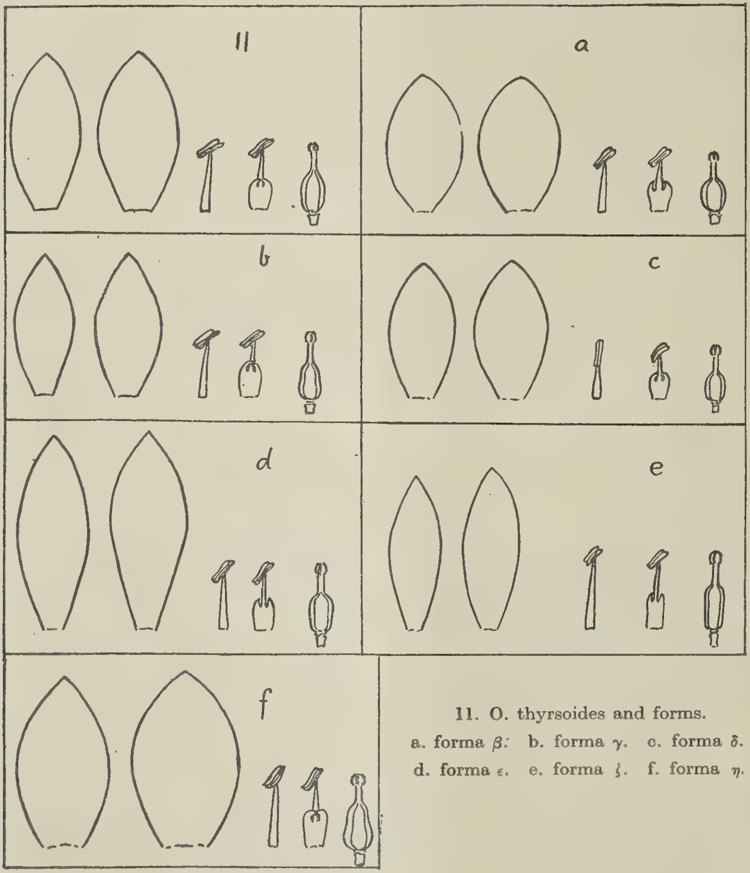
Ravine, *Wolley Dod* 977 ; Kirstenbosch, *Esterhuysen* 684, *Barker* 2606, *Leighton* in Bolus. Herb. 22686 ; Van Kamps Bay, *MacOwan* Herb. Norm. 940, *Zeyher* 733, (S.A. Mus. 23324), *Zeyher* 5045 (S.A. Mus. 23325), *Zeyher* S.A. Mus. 23322 ; Slopes of Twelve Apostles facing Hout Bay, *Goulimis* in Bolus Herb. 22809 ; damp cliffs W. side Table Mt., *Esterhuysen* in Bolus Herb. 22811 ; Devil's Peak, *Goulimis* in Bolus Herb. 22819 ; Karbonkelberg, *Salter* 2859 ; Chapmans Bay, *Wolley Dod* 3692, *Salter* 7816, *Lewis* in S.A. Mus. 53940 ; Marsh between Smitswinkel and Cirkels Vlei, *Salter* 4968, 1901 ; Bergvliet, *Leighton* in Bolus Herb. 22688 ; Wynberg Flats, *Prior* s.n. ; Camp Ground, *Zeyher* 4200 (S.A. Mus. 23359, 23401, 23402.) *Galpin* 3503 ; Signal Hill, *Marloth* 7268 ; Camps Bay, *Marloth* 306. Cape Flats, *Zeyher* 1679, 1680, *Pappe* in S.A. Mus. 23353, 23321 ; Malmesbury Div. : near Malmesbury, *Esterhuysen* in Bolus Herb. 22689 ; Bet. Malmesbury and Hopefield, *Lavis* in Bolus Herb. 20346 ; near Hopefield, *Lavis* in Bolus Herb. 22151 ; Groenekloof, *Bolus* 4350 ; near Mamre, *Salter* 4893B ; near Malmesbury, *Ryder* in Bolus Herb. 19989 ; near Mamre, *L. Bolus* in Bolus Herb. 22150 ; near Kalabas Kraal, *Leighton* 195 ; near Darling, *Leighton* 137 ; Langebaan, *Pillans* 6712, *Lewis* in Nat. Bot. Gdns. 2028/32, *Martley* in Bolus Herb. 22697 ; Between Mamre and Darling, *Salter* 6870. Stellenbosch Div. : near Somerset Strand, *Leighton* in Bolus Herb. 22690; Faure, *Compton* 15259; Sir Lowry's Pass, *Pells* in Bolus Herb. 22695 ; Vergelegen, Somerset West, *Barker* in Bolus Herb. 22147 ; near Bottelary, *Leighton* in Bolus. Herb. 22691, 22692, 22694, 22707 ; Jonkers Hoek, *Compton* 15263, 15261 ; Stellenbosch Golf Course, *Martley* in Bolus Herb. 22693. Clanwilliam Div. : Boekenberg, *Leighton* in Bolus Herb. 22146 ; Paleisheuvel, *Esterhuysen* in Nat. Bot. Gdns. 2371/34. Caledon Div. : Rivier Zonder Einde, *Walgate* in Bolus. Herb. 22696 ; Hermanus, near the sea, *Lavis* in Bolus Herb. 22152 ; Onrust River, *Esterhuysen* 2000 ; Hermanus, *Rogers* 29052.

[Fig. 11. Map III.]

Forma β. Inflorescence elongated not corymbose, ovary somewhat globose.

*Hab.* Piquetberg Div. : East base of Piquetberg, *Pillans* 8645 ; Pools, *Pillans* 9846 ; Papkuils Vlei, *Leighton* 135, *Barker* 2646 ; Between Piquetberg and Grey's Pass, *L. Bolus* in Bolus Herb. 22814, 22815 ; near Piquetberg, *Leighton* 189 ; near Redelinghuys, *Leighton* 188 ; Piquetberg, *Peers* in Bolus Herb. 22153. Clanwilliam Div. : Citrusdal, *Compton* in Nat. Bot. Gdns. 2011/36 ; Between Clanwilliam and Doorn River Bridge, *Pillans* 8369 ; Jan Diesels River, *Leighton* in Bolus Herb. 22698 ; Algeria, *Lamb* in Nat. Bot. Gdns. 1640/30 ; Pakhuis, *Leighton* in Nat. Bot. Gdns. 1493/33 ; Clanwilliam, *G. G. Smith* 2658. Calvinia

Div.: Nieuwoudtville, *Barker* in Nat. Bot. Gdns. 1768/30. Ceres Div.: Rosendalfontein, *Pillans* 9565; Between Gydo Pass and Elands Kloof, *Leighton* in Bolus Herb. 22701. Malmesbury Div.: Riebeek Kasteel, *Salter* 1791; Malmesbury, *Ryder* in Bolus Herb. 19982;



11. O. thyrsoides and forms.
a. forma β: b. forma γ. c. forma δ.
d. forma ε. e. forma ζ. f. forma η.

[Fig. 11A. Map III].

Forma γ. Inflorescence elongated, bracts long and conspicuous, perianth segments acute.

*Hab.* Piquetberg Div.: Verloren Vlei, *Pillans* 8116, *Leighton* 194; Kapiteins Kloof, *Pillans* 8089. Clanwilliam Div.: Alpha, Olifants River Valley, *Pillans* 9849; Olifants River Valley, *Pearson* 5337.

[Fig. 11b. Map III.]

Forma δ. Outer stamens expanded somewhat more than in the typical form, stamens less than half the length of the perianth segments. Seeds markedly denticulate on the angles.

*Hab.* Cape Div.: Melkbosch Strand, *Salter* 4888. Malmesbury Div.: Groenekloof, *Pappe* in S.A. Mus. 23355. Worcester Div.: Near Worcester, *L. Bolus* in Bolus Herb. 20348. Tulbagh Div.: Saron, *Lewis* in Bolus Herb. 22104; Tulbagh, *L. Bolus* in Bolus Herb. 22156; *Pappe* in S.A. Mus. 23364; Roodesand Mts., *Stokoe* in Bolus Herb. 22155; Artois, *Esterhuysen* 6078. Caledon Div.: near Caledon, *Salter* 4878; Viljoens Pass, *Salter* 4038; Between Napier and Caledon, *Barker* in Bolus Herb. 22145; Caledon, *Pillans* 9793, *Leighton* in Nat. Bot. Gdns. 1689/33, *Crocker* in Nat. Bot. Gdns. 1388/31, *Galpin* 4767, *Marloth* 8057.

[Fig. 11c. Map III.]

Forma ε. Perianth segments long and narrow, stamens relatively short.

*Hab.* Piquetberg Div.: near Berg River, *Leighton* 170; Berg River Islands, *Leighton* 196; Zoutkloof, *Leighton* 138; Pools, *Lewis* in Bolus Herb. 22847; Between Eendekuil and Moorreesburg, *L. Bolus* in Bolus Herb. 22848; Piquetberg, *Marloth* 6299. Malmesbury Div.: near Hopefield, *Leighton* 166, *Walgate* in Bolus Herb. 22821; Between Malmesbury and Hopefield, *Mathews* in Bolus Herb. 22822.

[Fig. 11d. Map III.]

Forma ζ. Pedicels short, erect never spreading. Perianth segments narrow, stamens relatively long, erect, ovary long ovoid.

*Hab.* Piquetberg Div.: near Sauer, *Leighton* 163; near Piquetberg *Leighton* 164; De Hoek, *Barker* 2570; Bottom of Versfeld's Pass, *Pillans* 1722. Paarl Div.: near Wellington, *Leighton* 445. Tulbagh Div.: Tulbagh, *Peers* in Bolus Herb. 22846; Twenty-four Rivers, *Lewis* in Bolus Herb. 22103. Malmesbury Div.: near Oude Post, *Salter* 3875; Oude Post Vlei, *Mathews* in Nat. Bot. Gdns. 2353/29; Between Kalabaskraal and Abbotsdale, *Lewis* in Nat. Bot. Gdns. 1866/32; Moorreesburg, *Marloth* 11486; W. side of the Piquetberg, *Marloth* 11039.

[Fig. 11e. Map III.]

Forma η. Peduncle stout, pedicels arcuate, leaves erect clasping the peduncle at the base. Style shorter than in the typical form, ovary somewhat conical.

*Hab.* Clanwilliam Div.: Kanolvlei, *Martin* in Nat. Bot. Gdns. 1746/37; *Barker* 296; *Lewis* in Bolus Herb. 22699. Calvinia Div.: Calvinia, *Green* in Nat. Bot. Gdns. 2800/32. Little Namaqualand: *Scully* 204; Besondermeid, *Taylor* 1202; between Garies and Khamieskroon, *Leighton* in Bolus Herb. 22700; Steinkopf, *Taylor* in Nat. Bot. Gdns.

3149/35 ; Klipvlei, between Garies and Khamieskroon, *Thorne* in S.A. Mus. 49961.

[Fig. 11 f. Map III.]

Kunth and Baker have stated that Linnaeus included both *O. arabicum* and *O. thyrsoides* in his description of *O. arabicum*, but from the literature available I can see no evidence for this. The citation from Royen's Hortus Lugdb. may possibly refer to a Cape Plant.

Jacquin states emphatically that the plant he describes as *O. thyrsoides* is quite distinct from that which Linnaeus knew as *O. arabicum*. He had seen the literature which Linnaeus quoted. The plant described and figured by Jacquin in Hort. Vind. III is undoubtedly that which grows most commonly in the South-western Cape. The typical form always has a ciliated leaf-margin, but in his description Jacquin says that the plant is glabrous and his illustration gives no indication of ciliation. Under greenhouse conditions this feature may have become much less conspicuous than it is in the wild state and may have been overlooked by the artist and by Jacquin in drawing up his description.

*O. thyrsoides* is a large and very variable species and, after repeated attempts to find a stable basis on which to divide the numerous forms into separate species, the author feels that this cannot be done satisfactorily without the help of cytological studies.

As can be seen on the accompanying map *O. thyrsoides* has a wide distribution ranging from Little Namaqualand through the South-Western Cape as far as Caledon. The centre of distribution appears to be the Malmesbury District.

12. **O. lacteum** Jacq. Coll. Suppl. 76; Ic. II 20, t. 434; Willd. Sp. Plant II, 117 ; Andr. Bot. Rep. t. 274 ; Red. Lil. VII t. 418 ; Kunth Enum. IV. 354 ; Bak. Journ. Linn. Soc. XIII, 283 (excl. var.) ; Bak. Fl. Cap. VI, 505 (excl. var.) ; *O. aestivum* L. Bolus S.A. Gardening XXIV, 50 ; *Aspasia lactea* Salisb. Gen. 34.

Plants up to 65 cm. high. *Bulbs* globose, white, 25—55 mm. diam. *Leaves* 4—6, leathery, oblong-lanceolate, usually completely dead at flowering time, 7—10 cm. long, 2—3 cm. broad, margins hyaline, densely fimbriate, apices obtuse or sub-acute. *Inflorescence* many-flowered, compact, bracts ovate with acute or acuminate apices, pedicels ascending 1—2 cm. long. *Perianth* white, segments long-ovate, obtuse, 15—20 mm. long, 7—10 mm. broad. *Stamens* about half as long as the perianth segments, filaments slender, three inner a little broader at the base than the outer. *Ovary* yellowish, ovoid, style slender, stigma papillose. *Seeds* black, verrucose, amongst the largest in the genus. Flowering Nov.—Jan.

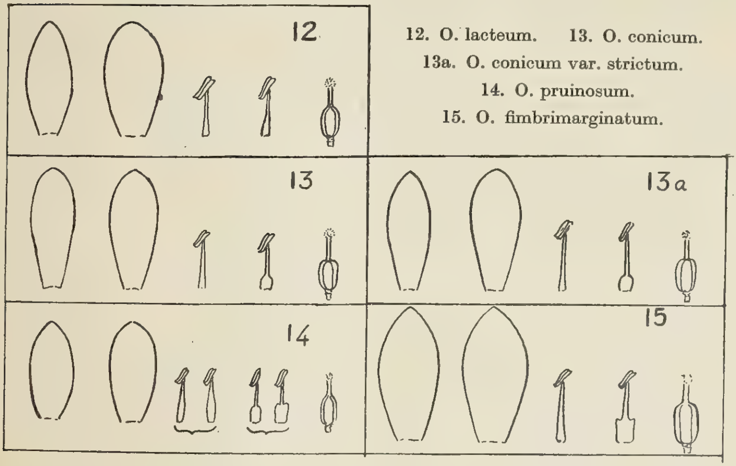
*Hab.* Cape Province. Cape Peninsula : Lions Head, *Goulimis* in

Bolus Herb. 22775, *Leighton* 175; Camps Bay, *MacOwan* 2652 (S.A. Mus. 23358), *Zeyher* 5047; Karbonkelberg, *Salter* 2860. Cape Div.: near Melkbosch, *Wasserfall* 779. Stellenbosch Div.: Gordons Bay, *Martley* in Bolus Herb. 22776, 22777. Clanwilliam Div.: *Foote* in Nat. Bot. Gdns. 1479/25. Malmesbury Div.: near Hopefield, *Pillans* 8370; between Malmesbury and Mamre, *L. Bolus* in Bolus Herb. 20974; Hopefield, *Letty* in Nat. Herb. 22826.

Most of the figures cited are of very luxuriant plants and the leaves are usually longer than any specimens found in the wild state.

[Fig. 12. Map. III.]

13. **O. conicum** Jacq. Coll. III, 232; Ic. II, 428; Willd. II, 118; Kunth Enum. IV, 354; O. lacteum Jacq. Bot. Mag. 1134; O. lacteum Jacq. var. conicum Bak. Journ. Linn. Soc. XIII, 284 (excl. Hook Bot. Mag. 3538.).



12. O. lacteum. 13. O. conicum.
13a. O. conicum var. strictum.
14. O. pruinosum.
15. O. fimbrimarginatum.

Plants up to 60 cm. high. *Bulb* ovoid up to 2 cm. diam. *Leaves* 3—6, ascending, frequently encircling the peduncle at the base, 10—20 cm. long, 10—25 mm. wide, margins ciliate. *Inflorescence* many-flowered, conical in the early stages, tending to elongate, bracts usually exceeding the pedicels, pedicels 5—20 mm. long. *Perianth* white, segments spreading widely, long-ovate, 15—20 mm. long, 6—8 mm. broad, apices obtuse or sub-acute. *Stamens* half as long as the perianth segments, filaments subulate three inner expanded at the base. *Ovary* ovoid, apex truncate, yellow, style slender, yellow, stigma capitate, papillose, style and stigma together as long as the ovary.

*Hab.* Cape Province. Calvinia Div.: Grasberg, *Ryders* in Nat. Bot. Gdns. 2272/30. Clanwilliam Div.: Pakhuis Pass, *Lewis* in Bolus Herb. 22799; Welbedacht, *Barker* 295.

[Fig. 13. Map IV.].

Var. **strictum** (L. Bolus) Leighton var. nov.

*O. strictum* L. Bolus Journ. Bot. LXXI, 72. This var. differs from the typical specimens in having a long narrow inflorescence, longer stamens and shorter pedicels.

*Hab.* Cape Province. Van Rhynsdorp Div.: Van Rhyns Pass, *Ross Frames* in Bolus Herb. 20072. Clanwilliam Div.: Nieuwoudt Pass, *Lamb* in Nat. Bot. Gdns. 1644/30; near Clanwilliam, *Salter* 2755; 2 miles S. of Clanwilliam, *Salter* 2805; *Marloth* 9455 (without particulars).

[Fig. 13A. Map IV.].

14. **O. pruinosum** Leighton sp. nov.

Plantae alt. ad 50 cm. *Bulbus* ovoideus, tunicis brunneis vel atris, duris. *Folia* 4—6, laete viridia, glauca, erecta, lanceolata vel oblongo-ovata, acuta vel sub-obtusa. *Inflorescentia* multiflorata; bracteae longo-acuminatae. *Perianthium* niveum, segmentis obtusis vel sub-acutis. *Filamenta*, tria exteriora simplicia, tria interiora basibus expansis. *Ovarium* ovoideum, viridi-flavum, stylo et stigmate flavis. *Semina* pustulata, angulis saepe papillosis.

*Hab.* Cape Province. Little Namaqualand: Between Garies and Khamieskroon, *L. Bolus* in Bolus Herb. 22781 (*Type*); Khamiesberg, *Thorns* in Herb. Nat. Bot. Gdns. s.n.; Klipfontein, *Mathews* in Nat. Bot. Gdns. 1889/31, *Pillans* 4935; Brakfontein, *Pillans* 5448, *Scully* 155. *Pearson* 7743; Arakup, *Schlechter* 11249; O'okiep, *Morris* in Bolus Herb. 5805; Richtersveld, *Marloth* 12350; Doorn River, *Herre* in Stell. Univ. Gdns. 3971; Kubus, *Herre* in Stell. Univ. Gdns. 3837; Kommaggas Kloof, *H. Bolus* 6597; Steinkopf, *Marloth* 6826; Khamieskroon, *Thorne* in S.A. Mus. 48847; Springbok, *Henrici* 2177. Van Rhynsdorp Div.: Van Rhynsdorp, *Kolbe* in Bolus Herb. 14312; Between Nieuwerust and Van Rhynsdorp, *Leipoldt* 4028; Klaver, *Ross Frames* in Nat. Bot. Gdns. 1259/26; Van Rhyns Pass, *Lewis* in S.A. Mus. 53354. Clanwilliam Div.: Diamond Drift, *Leipoldt* 3111. Kenhardt Div.: near Kenhardt, *Leipoldt*, Aughrabies Falls, *Leipoldt* in Nat. Bot. Gdns. 1048/36. Calvinia Div.: Loeriesfontein, *Marloth* 12855; Calvinia, *Marloth* 10244. Laingsburg Div.: Dwars-in-de-Weg, *Marloth* 9841.

Plants up to 50 cm. high usually 25—40 cm. *Bulb* ovoid, 2—3 cm. diam., encased in hard blackish tunics. *Leaves* 4—6, pale glaucous green, erect or ascending, lanceolate or ovate-lanceolate up to 17 cm. long, 3 cm. broad, apices acute or sub-acute, margins hyaline, sometimes crisped, usually minutely ciliated but often entire. *Inflorescence* dense, many-flowered, often somewhat lax in garden grown specimens, bracts long-acuminate, greenish, pedicels 3—4 cm. long, spreading. *Perianth* white, segments spreading widely often with a faint green median stripe on the under surfaces when young, 12—25 mm. long, 7—10 mm. broad, apices acute or obtuse. *Stamens* usually erect, outer stamens simple, inner stamens somewhat expanded at the base. The stamens are very variable even in the same flower ; in some the expansion of the bases is spathulate, in others there are wing-like outgrowths produced upwards. *Ovary* ovoid, greenish yellow, style slender, yellow, stigma yellow. *Seeds* pustulate, angles often markedly papillose.

Flowering Aug.—Oct.

[Fig. 14.]. Two forms of the outer and two forms of the inner stamen are given to show the amount of variation.

[Map IV.].

This species differs from *O. lacteum* and *O. conicum* in the form and texture of the leaves and in the character of the stamens.

15. **O. fimbrimarginatum** Leighton sp. nov.

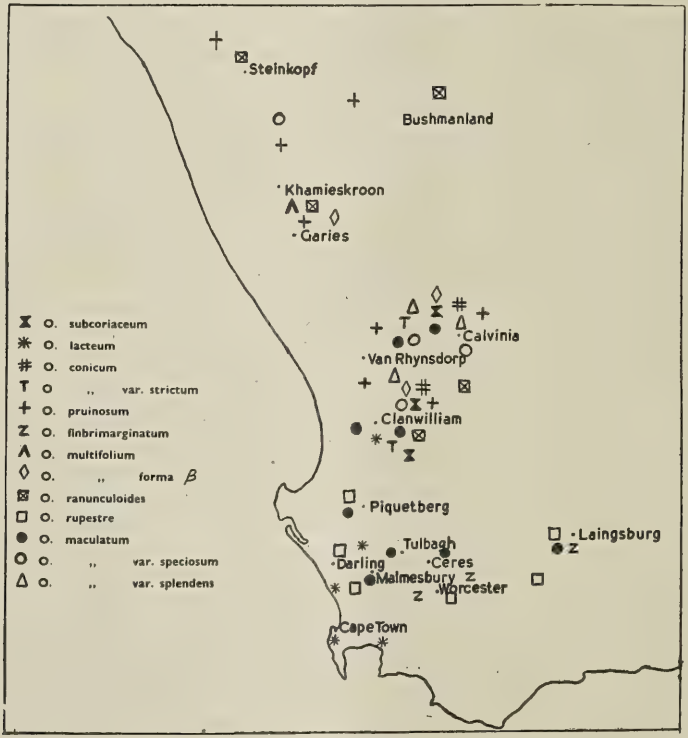
Plantae alt. 20—50 cm. *Bulbus* globosus, tunicis externis duris, atris. *Folia* 4—5, ovata vel ovato-lanceolata apicibus obtusis, marginibus conspicuis, dense ciliatis. *Inflorescentia* pauci-vel multiflorata. *Perianthium* niveum, segmentis acutis vel sub-acutis. *Stamina*, tria exteriora sulcata, tria interiora basibus expansis. *Ovarium* ovoideum stigmate conspicuo capitato. *Semina* papillosa, papillis obtusis, rare echinata.

*Hab.* Laingsburg Div. : Whitehill Ridge, south slope, *Leighton* 273 (*Type*, in Bolus Herb. and Herb. Nat. Bot. Gdns.), *Compton* 5903. Ceres Div. : Laken Vlei, *Phillips* 2084 (S.A. Mus. 11884). Worcester Div. : Matroosberg, *Stokoe* 7605 ; Slanghoek Pile, *Esterhuysen* 1771 ; Waaihoek, *Pells* in Bolus Herb. 22818 ; Mostert Hoek Twins, *Esterhuysen* 9317 ; Omklaarberg, *Stokoe* 1138 ; Elskloof, above Hex River, *Davidson* 32 ; De Doorns, *Davidson* 31 (S.A. Mus. 141). Paarl Div. : April Peak, *Esterhuysen* 4122; Mts. S. of Wemmershoek, *Andreae* 764 ; Witzenberg, *Andreae* 177.

Plants 20—50 cm. high. *Bulb* globose, 15—25 mm. diam. with tough, black, outer tunics. *Leaves* 4—5, ovate or ovate-lanceolate, arranged in a rosette, dying at the flowering period, 5—10 cm. long, 10—35 mm. broad. *Inflorescence* few- to many-flowered, corymbose ; bracts membranous, ovate-cuspidate, shorter than the pedicels. *Perianth* white, segments acute or sub-acute, spreading widely, up to 22 mm. long, 10 mm. broad. *Stamens* about half the length of the perianth, three outer filaments simple but rather thick and grooved down the inner face, three inner with winglike expansions in the lower half. *Ovary* ovoid, green at the base, bright yellow at the apex which tapers into the style, stigma conspicuous, capitate, papillose. *Seeds* with short blunt papillae, rarely echinate. Flowering Nov.

[Fig. 15. Map IV].

This species differs from *O. lacteum* in having the inner filaments expanded and in the character of the testa. It is very close to *O. conicum* but differs from that species in having a laxer corymbose inflorescence and leaves of a tougher texture which do not enfold the base of the peduncle.



Map IV.

*O. fimbrimarginatum* is a species with considerable variation in the stamens, in the length of the style and in the nature of the testa, but the differences are too indefinite to warrant making varieties.

16. **O. multifolium** Bak. Journ. Linn. Soc. XIII, 271.

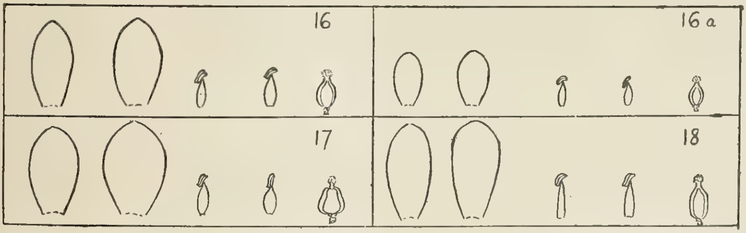
Plants 15—25 cm. high. *Bulb* depresso-globose, 15—20 mm. diam. *Leaves* many, sub-terete, glaucous, erect or sub-erect 6—12 cm. long, 3—6 mm. diam. at the vaginate base, tapering to a filiform tip. *Inflorescence* usually dense, sub-corymbose sometimes few-flowered. *Perianth* yellow, spreading widely, segments ovate-lanceolate, acute or subacute, 10—12 mm. long, 4—6 mm. broad. *Stamens* short, filaments expanded sub-equal. *Ovary* ovoid, style short, stigma lobes decurrent. Flowering Sept.—Oct.

*Hab.* Cape Province. Little Namaqualand : *Scully* 173 ; between Garies and Khamieskroon, *Leipoldt* 3357 ; near Bethal, *Stokoe* in Herb. Marloth (s.n.) ; *Zeyher* 4204 ; trans Olifants River, *Zeyher* in S.A. Mus. 23314 (under *Pappe.*)

[Fig. 16. Map IV.]

Forma β. differs chiefly in that it is smaller in every respect.

*Hab.* Clanwilliam Div.: Pakhuis, *Esterhuysen* 4384; between Oorlogskloof and Papkuilsfontein, *Leipoldt* 4090. Calvinia Div. : Nieuwoudtville, *Compton* in Nat. Bot. Gdns. 1528/26. Ceres Div. : Bokkeveld, *Marloth* 7524. Little Namaqualand : *Scully* Herb. Norm. 1391 ; near Garies, *Esterhuysen* 1290.



16. O. multifolium. 16a. O. multifolium forma β. 17. O. ranunculoides. 18. O. rupestre.

[Fig. 16a. Map IV.]

The author has been unable to see the *Whitehead* plant cited by Baker as his type, but from the description *Scully* 173 would seem to be the same species. This specimen has no colour note of the flower and has faded to appear white. No white-flowered specimen has hitherto been found of the species in this group and it is doubtful whether Baker's statement is correct.

**17. O. ranunculoides** L. Bolus S.A. Gardening XXIII, p. 61 (1933).

Plants 12—23 cm. high. *Bulb* ovoid or globose, white, up to 2 cm. diam. *Leaves* 3—5, sub-terete, glaucous, 5—10 cm. long, 1—5 mm. diam., sometimes more at the base which is vaginate for 1—2 cm. *Inflorescence* few-flowered, sub-corymbose, bracts short, broad. *Perianth* golden yellow, cup-like, segments broad, obtuse, concave, never spreading widely, up to 13 mm. long and 8 mm. broad. *Stamens* short, all filaments broadly expanded, three inner wider than three outer, 4—5 mm. high, 2—3 mm. broad. *Ovary* sub-globose, style short, stigma lobes decurrent. Flowering Sept.—Oct.

*Hab.* Cape Province. Little Namaqualand: Steinkopf, *Marloth* 6297, *Herre* in Stell. Univ. Gdns. 3972, 3978; Klipfontein, *Mathews* in Nat. Bot. Gdns. 1888/31; Goechas, *Schlechter* 11368; *Morris*, Herb. Bolus 5806; between Steinkopf and Orange River, *Phillips* 1634 (S.A. Mus. 9011).

[Fig. 17. Map IV.]

18. **O. rupestre** L.f. Suppl. 199; Thunb. Prod. 61; Thunb. Fl. Cap. edit. Schultes 313 (in part); *O. aurantiacum* Bak. Gard. Chron. X, 748, 1878.

Plants 4—15 cm. high. *Bulb* white, sometimes with brownish outer tunics, globose or ovoid, 10—15 mm. diam. *Leaves* 3—6, slender sub-terete, glaucous, vaginate at the base, 3—6 cm. long, 1—2 mm. diam. *Inflorescence* 1—5-flowered, bracts papery, broad, enfolding the pedicels, usually as long as or longer than the pedicels. *Pedicels* 5—15 mm. long, erect or ascending. *Perianth* yellow or orange, segments spreading, acute or sub-acute, 10—15 mm. long, 4—6 mm. wide. *Stamens* less than half as long as the perianth segments, filaments all expanded gradually from apex to base, three inner broader than the three outer. *Ovary* ovoid, style very short, stigma lobes decurrent, papillose. Flowering Aug.—Oct.

*Hab.* Cape Province. Malmesbury Div.: Groenekloof, *Pappe* in S.A. Mus. 23315 (cited by Baker in Flor. Cap.); Kapocberg, *Bolus* 12892; Groot Post, *Salter* 6226. Piquetberg Div.: Boesmans Kloof River, *Leighton* 161; Mouton Valley, *Marloth* 11496. Clanwilliam Div.: Pakhuis Pass, *Lewis* in Bolus Herb. 22858; Graafwater, *Salter* 2746. Worcester Div.: De Doorns, *Bolus* 13065. Laingsburg Div.: Matjesfontein Karoo, *Compton* 3585; Whitehill, *Barker* in Bolus Herb. 22857, *Compton* 14848 Joseph's Kraal, *Wilmot* 1 in Nat. Herb.; Hillandale, *Marloth* 11434. Montagu Div.: Along road to Touws River, *Lewis* in Bolus Herb. 22856.

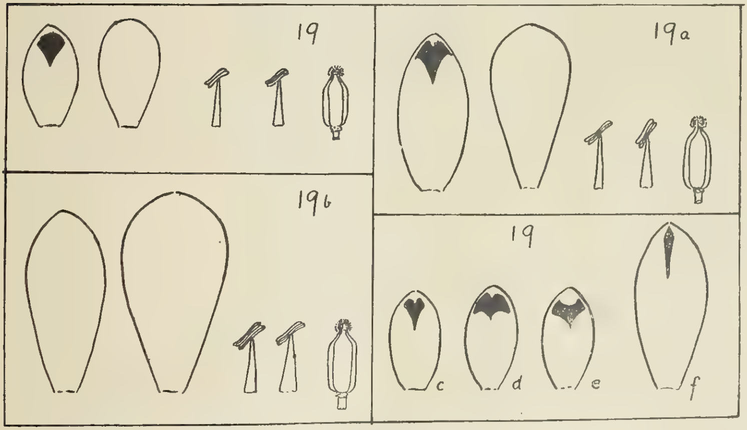
[Fig. 18. Map IV.]

The author has rejected that part of Thunberg's description in his Flora Capensis p. 313 which refers to a white-flowered form from Witteklip since this has not been found to occur anywhere else, and is probably a different species. When it is possible to visit Witteklip near Saldanha Bay this problem may be solved. The yellow form from Groenekloof is without doubt the plant which Baker described as *O. aurantiacum*.

19. **O. maculatum** Jacq. Coll. II, 368, t. 18, f. 3; Thunb. Prodr. 62;

Thunb. Fl. Cap. edit Schultes 314 ; Kunth Enum IV 352 ; *O. thunbergianum* Bak. Journ. Linn. Soc. XIII, 269 ; Bak. Fl. Cap. VI 497 ; *Phaeocles maculata* Salisb. Gen. Pl. 35.

Plants 10—50 cm. high. *Bulb* ovoid, globose or depresso-globose, 1—3 cm. diam. *Leaves* 2—5, erect or ascending, glaucous, semi-fleshy, broad at the base and often sheathing the peduncle, 5—15 cm. long, 5—30 mm. broad, apex acute or sub-acute. *Inflorescence* 1—8-flowered, bracts dry, papery, acuminate from a broad base, usually longer than the pedicels ; pedicels often arcuate ; pedicels 1—3 cm. long, not lengthening appreciably as the flower ages. *Perianth* golden, yellow, orange or orange-red, three outer segments usually tipped or spotted with black near the apex, obtuse or sub-acute, 15—30 mm. long, 8—12 mm. broad; three inner segments obovate, obtuse 15—30 mm. long, 8—16 mm. broad. *Stamens* about half the length of the perianth segments, filaments simple, yellow or orange, white at apex and base, three inner somewhat broader than the outer. *Ovary* oblong, obtusely angled, pale yellow-green, 5—9 mm. long, 3—4 mm. diam. *Style* absent or almost so. *Stigma* large, with decurrent papillose lobes. *Seeds* small, minutely verrucose. Flowering Sept.—Oct.



**19, 19c; d, e. O. maculatum. 19a, 19f. O. maculatum var. speciosum. 19b. O. maculatum var. splendens.**

*Hab.* Malmesbury Div. : near Malmesbury, *Bolus* 4346. Piquetberg Div. : Kapiteins Kloof, *Pillans* 8088 ; Groenvlei, *Guthrie* 2712 ; Sauer, *Barker* 2662 ; Grey's Pass, *Lewis* in Bolus Herb. 20699. Tulbagh Div. : Tulbagh Kloof, *Esterhuysen* 6061 ; Tulbagh, *Peers* in Bolus Herb. 22828, *Grant* 2425, *Guthrie* 2391 ; New Kloof, *Compton* 11700. Clanwilliam Div.: Clanwilliam, *Stell. Univ. Gdns.* 869; near Sandberg, *Leighton* in Bolus Herb. 21621; near base of Sneeuwkop, *Leighton* in Bolus Herb. 21620; Clanwilliam, *Peers* in Bolus Herb. 17543; Nieuwoudt Pass, *Esterhuysen* 8159; Kromme River, *Leighton* in Bolus Herb. 21622; Algeria, *Barnes* in Bolus Herb. 19281; Elands Kloof, *Lewis* in Bolus Herb. 22087, *Compton* 9692, *Esterhuysen* 4360; Pakhuis, *Barker* 294, *Compton* 9571, *Wagener* 208, *Leipoldt* in S.A. Mus. 23309; Olifants River, *Zeyher* in S.A. Mus. 23308 (under *Pappe*); *Zeyher*, Saldanha Bay in S.A. Mus. s.n. (under *Pappe*). Calvinia Div.: Top of Van Rhyn's Pass, *Esterhuysen* 5662, *Barker* 1925; Graskop to Nieuwoudtville, *L. Bolus* in Bolus Herb. 19832. Ceres Div.: Karoo Poort, *Barker* 1921. Laingsburg Div.: Tweedside, *Compton* 3127, *Lewis* in Bolus Herb. 22829; Witteberg, *Compton* 3565; Whitehill Ridge, *Compton* 14846.

[Fig. 19 and Fig. 19c., d., e (showing variation in spotting). Map IV.]

Var. **speciosum** (Bak.) Leighton var. nov.

*O. speciosum* Baker in Journ. Bot. Vol. XX, p. 72. *O. thunbergianum* Bak. S.A. Fl. Plants, pl. 65. *O. insigne* Leighton nom. nov. Journ. S.A. Bot. IX, 113.

This form differs from the typical chiefly in size; it is larger in every respect and occurs in the North-western districts.

*Hab.* Cape Province. Little Namaqualand: *Scully* 175, *Scully* in Herb. Norm. 1390, *Zeyher* 4203 (S.A. Mus. 23310); *Ecklon and Zeyher* Brakfontein in S.A. Mus. 23311; North of Khamieskroon, *Leighton* 447; Khamieskroon, *Thorne* in S.A. Mus. 48851. Calvinia Div.: Calvinia, *MacPherson* in Nat. Bot. Gdns. 3474/14, *Stewart* in Bolus Herb. 22823; Van Rhyn's Pass, *Salter* 1616; *Phillips* Sladen Mem. Exped. 7653. Van Rhynsdorp Div.: *Herre* in Stell. Univ. Gdns. 968. Clanwilliam Div.: Kanolvlei, *Lewis* in Bolus Herb. 22824; Olifants River, *Pappe* in S.A. Mus. 23308 (plant probably collected by *Zeyher*).

[Fig. 19a and f. Map IV.]

Var. **splendens** (L. Bolus) Leighton var. nov.

*O. splendens* L. Bolus S.A. Gardening. Vol. XXI, 13 (1931). *O. aureum* Andr. Bot. Rep. 505.

Differs from the typical in having larger, immaculate flowers and broader filaments.

Calvinia Div.: near Nieuwoudtville, *Buhr* in Nat. Bot. Gdns. 2654/30, *Nieuwoudt* in Nat. Bot. Gdns. 2134/34, *Starke* in Bolus Herb. 17831, *Naish* in Nat. Bot. Gdns. 1667/30; near Calvinia, *Stewart* in Bolus Herb. 22827, *Marloth* 6657. Van Rhynsdorp Div.: Van Rhynsdorp, *A. A. Schmidt* 246 in Nat. Herb. Clanwilliam Div.: Clanwilliam, *Leipoldt* 237 (S.A. Mus. 23333).

[Fig. 19b. Map. IV.]

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# A REVISION OF THE SOUTH AFRICAN SPECIES OF ORNITHOGALUM L.

By Frances M. Leighton.

## PART II.

### Key to the Species 20–32.*

Flowers yellow or yellowish with a broad median green stripe, sweetly scented, style excentric in young flowers, seeds subdiscoid.
  Leaves 2—5, opposite.
    Leaves flat, spreading .. .. .. .. .. 20 Pearsonii.
    Leaves canaliculate erect or sub-erect at the base, often encircling the base of the peduncle.
      Filaments expanded gradually from the apex to the base .. .. .. .. .. .. .. 21 suaveolens
      Filaments expanded abruptly in the lower half.. .. 22 Muirii.
  Leaves many, arranged in a rosette.
    Margins entire.
      Leaves terete or sub-terete, flattened or canaliculate at the base only .. .. .. .. .. 23 polyphyllum.
      Leaves flat or broadly canaliculate, spreading.. .. 24 odoratum.
    Margins coarsely ciliate or muricate .. .. .. 25 secundum.
Flowers white, yellowish or fuscous with a brownish median stripe, style erect.
  Leaves many, narrow or filiform, peduncle wiry, seeds angled.
    Leaves 5 cm. or less in length.
      Inflorescence lax, few-flowered.
        Leaves sinuose, at least in the upper half .. .. 26 tortuosum.

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* Key to species 1—19 appears on p. 87. A final key to all the species will be published when the several parts are completed.

| | |
|---|---|
| Leaves straight or slightly recurved at the apex .. | 27 nanodes. |
| Inflorescence dense, many flowered, scarcely taller than the leaves .. .. .. .. .. | 28 Comptonii. |
| Leaves 10—20 cm. long, inflorescence tall.. .. .. | 29 epigeum. |
| Leaves 1—3, long-ovate or lorate, peduncle fleshy, seeds subdiscoid. | |
| Leaf solitary, pedicels 1 cm. or less in length .. .. | 30 solitarium. |
| Leaves 2 or more, rarely one, if one then pedicels more than 1 cm. long. | |
| Leaf margins crenulate, coarsely ciliate when young .. | 31 crenulatum. |
| Leaf margins smooth, finely pubescent when young .. | 32 cinnamomeum |

20. **O. Pearsonii** Leighton sp. nov.

Plantae alt. circa 70 cm. *Bulbus* ovoideus, diam. 3—4 cm., tunicis coriaceis. *Folia* 2, lorata, long. 25 cm. vel ultra, lat. 25—30 mm., marginibus hyalinis. *Inflorescentia* multiflora. *Perianthium* patens vel reflexum, flavum vel albidum, viridi-vittatum, segmentis obtusis, subcucullatis interioris barbatis. *Stamina* erecta subaequalia, filamentis basi expansis. *Ovarium* oblongum, stylo longo, stigmate penicillato. *Semina* rugosa, angulata, atra.

*Hab.* South-West Africa. Great Karasberg, Naruda Süd, *Pearson* in Sladen Mem. Exped. 8225.

Plants 70 cm. or more high. *Bulb* ovoid, 3—4 cm. diam. with leathery outer tunics. *Leaves* 2, lorate, 25 cm. or more in length, 25—30 mm. broad, margins hyaline. *Inflorescence* tall, many-flowered, bearing flowers for more than half the length of the peduncle ; pedicels spreading. *Perianth* yellow or whitish with a median green stripe down each segment, segments obtuse, subcucullate, spreading or reflexing 10—14 mm. long, 3—4 mm. broad, three inner segments barbate. *Stamens* erect, subequal, filaments expanded from the middle to the base. *Ovary* oblong, style and stigma together considerably longer than the ovary, stigma distinctly trilobed, penicillate. *Capsule* broad with large angled rugose seeds.

Fl. Jan.

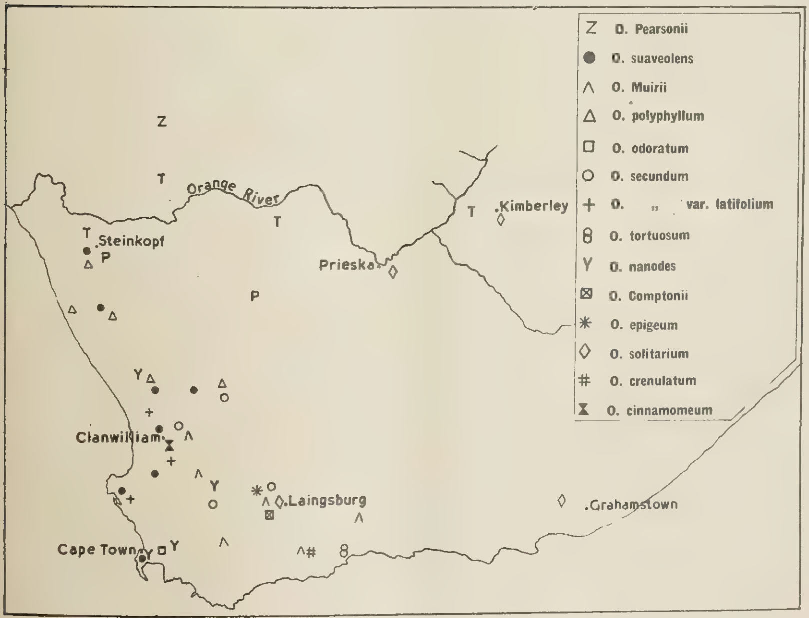
[Fig. 20. Map V.]

This species may prove to be one already described from South-West Africa, but many of the descriptions are very inadequate and it will only be possible to settle the question when the types are available.

21. **O. suaveolens** Jacq. Coll. II, 316 ; Ic. II, 19, t. 431. Willd. Sp. Pl. II, 122 ; Roem. et Schultes, Syst. Veg. VII, 523 ; Kunth Enum. IV, 366 ; Bak. in Journ. Linn. Soc. XIII, 279 ; *O. barbatum* Jacq. Hort. Schoenb. I, 47, t. 91 ; Willd. Sp. Pl. II, 122 ; Roem. et Schultes, Syst. Veg. VII, 523 ; Kunth Enum. IV, 366 ; Bak. in Journ. Linn.

Soc. XIII, 278; *O. albucoides* Thunb. Fl. Cap edit. Schultes, 314; Kunth Enum. IV, 367; *O. Roodeae* Phill. in Fl. Pl. S.A. pl. 75; *Phalangium albucoides* Poir. Encycl. V, 249; *Anthericum albucoides* Ait. Hort. Kew, edit. (i) I, 449; edit. (ii) II, 269; Roem. et Schultes, Syst. Veg. VII, 472; Kunth Enum. IV, 367.

Plants up to 50 cm., usually 20—30 cm. high. *Bulbs* ovoid or globose 2—3 cm. diam., with papery outer tunics. *Leaves* 2—4, opposite, linear, glabrous, juvenile stage often terete or semiterete, but flattening and becoming somewhat channelled down the face and flaccid with age, 10—25 cm. long, 3—20, usually about 10 mm. broad at the base; leaves absent at the flowering time but remains often persisting. *Inflorescence* lax, few—many-flowered, bracts often as long as the pedicels. *Flowers* sweetly scented, open in the morning, closing in the afternoon. *Perianth* bright yellow with a broad green median stripe, segments spreading, oblong, 12—20 mm. long, 4—6 mm. broad, apices obtuse, subcucullate, three inner segments broader than the three outer, barbate. *Stamens* erect, more than half as long as the perianth, filaments yellowish or greenish in colour, all gradually expanded from the apex to the base;



MAP V.

the degree of expansion varies but there is never a lobed or winglike structure. *Ovary* green, ovoid, style and stigma together much longer than the ovary, style slender; deflected to the side, stigma conspicuously penicillate. *Capsule* broad, deeply lobed, seeds black, flattened.

Fl. Sept.—Nov.

*Hab.* Cape Province. Cape Peninsula: Lion's Head, *Leighton* 299, 394, *Bolus* 8028, *Compton* 15360; Signal Hill, *Penfold* 141; Wilde Vogel Vlei (Imhoffs Gift), *Esterhuysen* 3508. Cape Div.: Visser's Hok, *Barker* 2539; Milnerton, *Levyns* in B.H. 22875. Malmesbury Div.: Bet. Mamre and Melkbosch Rd., *Leighton* 395; near Mamre, *L. Bolus* in B.H. 22876; Mamre Flats, *Compton* 13876; near Darling, *Esterhuysen* 3862, *Bolus* 12893; Top of Botma's Kloof, Riebeeck Kasteel, *Esterhuysen* 6037; Bet. Moorreesburg and Berg River Bridge, *Pillans* 6704; near Moorreesburg, *Bolus* 9985; Langebaan, *Pillans* 6959, *Leighton* in B.H. 22877. Piquetberg Div.: Berg River Bridge, *Lewis* in B.H. 22878; near Sauer, *Barker* 2664, *Leighton* 140; near Berg River (Zout Kloof), *Leighton* 141; Skrik-van-Rondom, *Leighton* in B.H. 21625; Antonies Rivier, *Leighton* 96; Koppie, Het Kruis, *Barker* 2590. Clanwilliam Div.: Bet. Grey's Pass and Graafwater, *Leipoldt* 3251; Graafwater, *Peers* in Nat. Bot. Gdns. 2059/24; Bet. Lamberts' Bay and Graafwater, *Lavis* in B.H. 22879; Clanwilliam, *Thode*, A2144; Pakhuis, *Salter* 7509, *Leipoldt* in B.H. 22880. Van Rhynsdorp Div.: Klaver, *Ross Frames* in Nat. Bot. Gdns. 1218/26; Van Rhynsdorp, *Rood* in Nat. Herb. 22823, 22824 and in Nat. Bot. Gdns. 924/25. Calvinia Div.: Brandkop, *Stokoe* 7678; Nieuwoudtville, *Barker* in Nat. Bot. Gdns. 1749/30. Little Namaqualand. Khamieskroon, *L. Bolus* in B.H. 22881; Steinkopf, *Marloth* 12479.

This species is very variable in the size of the plant, the nature of the leaves, the density of the inflorescence, and in the expansion of the filaments. Further work may indicate which characters are sufficiently stable to be used as the basis of varieties or even species. At present it seems wiser to define *O. suaveolens* as a large and very variable species.

Jacquin published figures of *O. barbatum* (Hort. Schoenbr. t. 91) and *O. suaveolens* (Ic. II, t. 431) which in themselves appear distinct but so many intermediate forms occur that they must be considered as a single species.

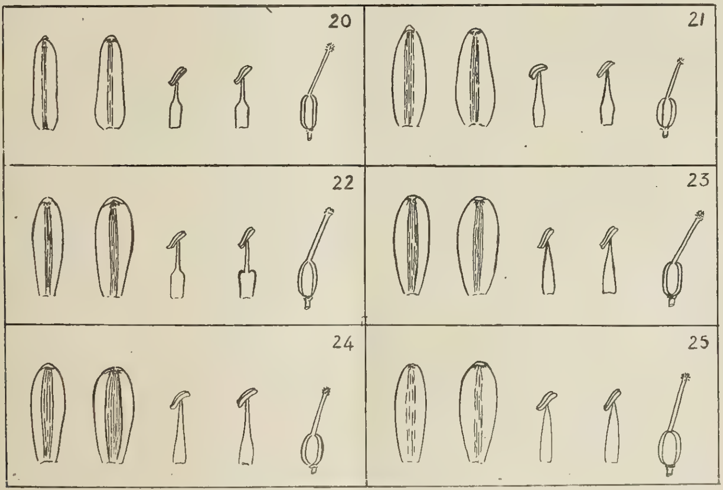
The colouring of *O. Roodeae* is as far as the author can ascertain the only character which separates it from *O. suaveolens* and, since this reddish or purplish colour is observed in other plants growing in the Van Rhynsdorp area (especially the Knechtsvlakte) it is probably due to soil and climatic conditions.

[Fig. 21. Map V.]

22. **O. Muirii** Leighton sp. nov.

Plantae alt. ad 60 cm., saepius 30—40 cm. *Bulbus* globosus, albus. *Folia* 2, linearia, canaliculata. *Inflorescentia* multi- vel pauciflora. *Perianthii segmenta* flava viridi-vittata, oblonga, obtusa, patentia, apicibus subcucullatis, minute barbatis. *Stamina* erecta, filamentis basi expansis, tribus interioribus lobatis. *Ovarium* ovoideum; stylus longus, excentricus; stigma penicillatum. *Capsula* conica; semina atra, planiuscula, semidiscoidea.

*Hab.* Cape Province. Laingsburg Div.: Whitehill Ridge, *Leighton* 234 (*Type*); Bantams Karoo, *Compton* 12172. Montagu Div.: Koo, *Compton* 3909. Riversdale Div.: Hills near Riversdale, *Muir* 2673, 2676. George Div.: Ganz Kraal, Lang Kloof, *Fourcade* 4702. Ceres Div.: Paardekop near Spes Bona, *Marloth* 12534. Clanwilliam Div.: Summit of Sneeukop, Cederberg, *Esterhuysen* 7552; Krakadouwsberg *Esterhuysen* 7484; Top of Nieuwoudt Pass, *Esterhuysen* 8128; Pakhuis, *Esterhuysen* 3176; Lamkraal, *Bolus* 9107.



20. O. Pearsonii. 21. O. suaveolens. 22. O. Muirii. 23. O. polyphyllum. 24. O. odoratum. 25. O. secundum. (All figures natural size.)

Plants up to 60 cm. high, usually from 30—40 cm. *Bulb* ovoid or globose, whitish 2—3 cm. diam. *Leaves* 2, linear, channelled down the face, encircling the peduncle at the base, often as long as the peduncle, usually shorter, 6—10 mm. broad at the base, tapering gradually to the apex. *Inflorescence* lax, few—many-flowered. *Perianth* spreading,

flowers opening in the morning and closing in the afternoon, segments yellow with a median green stripe, oblong, 12—15 mm. long, 4—5 mm. broad, apices obtuse, subcucullate, barbate. *Stamens* erect, filaments greenish, all abruptly expanded in the lower half, three inner somewhat broader than the outer with lobed apices to the basal expansions. *Ovary* ovoid; style at least twice as long as the ovary; stigma conspicuously penicillate, style and stigma deflected to one side. *Capsule* broadly conical, deeply lobed; seeds black, flattish, semicircular.

Fl. Aug.—Oct. at lower altitudes, Dec.—Jan. at altitudes of 5—6,000 ft.

[Fig. 22. Map V.]

23. **O. polyphyllum** Jacq. Collect. Suppl. 79; Ic. II, 19, t. 430. Willd. Sp. Pl. II, 123; Roem. et Schultes VII, 524; Kunth Enum. IV, 366; *O. sanguineum* Kunth Enum. IV, 368; *O. tuberosum* Bak. in Fl. Cap. VI, 506; *O. odoratissimum* C. A. Smith Fl. Pl. S. A. pl. 194.

Plants 30—60 cm., rarely about 20 cm., high. *Bulb* ovoid or globose, 2—5 cm. diam., with rough leathery outer tunics. *Leaves* many, erect, linear, terete or semiterete, flattened or somewhat canaliculate at the base, 10—25 cm. long, 4—8 mm. broad, synanthous, though often withered at the apices. *Inflorescence* rather lax, often bearing flowers for about half its length, bracts often as long as the pedicels. *Perianth-segments* whitish or yellow with a median green stripe, somewhat cucullate and barbate at the apex, 12—15 mm. long, 4—5 mm. broad. *Stamens* subequal, filaments lanceolate, somewhat thickened, 8—10 mm. long. *Ovary* oblong, 3—5 mm. long, style 6—8 mm. long, stigma capitate, penicillate, style and stigma deflected to the side. *Capsule* conical. *Seeds* black, flattened, semidiscoid.

Fl. Aug.-Sept.

*Hab.* Cape Province. Little Namaqualand: Spektakel, *Esterhuysen* 5665, *Compton* 11461; Nabapeep, *Ridgill* in Nat. Bot. Gdns. 3805/14; O'okiep, *Bolus* 6599, *Morris* s.n.; Soebatsfontein, *Compton* 5959; Khamiesberg, *Marloth* 12481; Garies, *Barker* 1920; Bet. Garies and Hondeklip Bay, *Lewis* in Nat. Bot. Gdns. 2054/32, *Leighton* in B.H. 20700; Leliefontein, *Leipoldt* 3862. Van Rhynsdorp Div.: Bet. Bitterfontein and Garies, *Esterhuysen* 5671; Van Rhynsdorp, *Rood* in Nat. Bot. Gdns. 920/25, *Marloth* in Nat. Herb. 3001. Calvinia Div.: Calvinia, *Thode* A1955.

[Fig. 23. Map. V.]

24. **O. odoratum** Jacq. Coll. Suppl. 78; Ic. II 20, t. 432; Willd. Sp. Pl. II, 121; Roem. et Schultes, Syst. Veg. VII, 523; *O. suaveolens* Jacq., Bak. in Fl. Cap. VI, 507 (in part).

Plants up to 60 cm. high. *Bulb* globose, 3—4 cm. diam. *Leaves* linear, glabrous, somewhat fleshy, arranged in a rosette, 10—17 cm. long, 10—12 mm. broad, apex subacute. *Inflorescence* slender, lax, many-flowered. *Perianth* spreading, segments yellow with a broad median green stripe, 12—15 mm. long, 5—7 mm. broad, apices subcucullate, three inner segments barbate. *Stamens* subequal, subulate. *Ovary* ovoid, style slender, stigma penicillate, style and stigma deflected to the side in immature stage. *Capsule* up to 15 mm. long and 8 mm. broad at the base. *Seeds* flattish, black, angled or subdiscoid.

Fl. Oct.

*Hab.* Cape Province. Stellenbosch Div.: Sandy flats on the Bottelary road, *Pillans* 9548.

*O. odoratum* differs from *O. suaveolens* in the form and arrangement of the leaves.

[Fig. 24. Map V.]

25. **O. secundum** Jacq. Coll. Suppl. 79; Ic. II, 20, t. 433. Willd. Sp. Pl. II, 122 (excl. syn. *O. maculatum* Thunb.); Roem. et Schultes VII, 527; Kunth Enum. IV, 369; Bak. Fl. Cap. VI, 506; *Urginea secunda* Bak. in Journ. Linn. Soc. XIII, 222. *Monotassa secunda* Salisb. Gen. 37.

Plants up to 30 cm. high, usually 10—20 cm. *Bulb* globose, 2—4 cm. diam., with tough, blackish tunics. *Leaves* many, arranged in a rosette, erect or suberect, lingulate, often lengthening and becoming lorate, 5—20 cm. long, 1—2 cm. broad, firm in texture, becoming leathery with age, usually disappearing completely at the flowering time, margins conspicuously hyaline with coarse denticulation or ciliation. *Inflorescence* pyramidal, often lengthening in the fruiting stage. *Perianth* yellow with green median stripe, segments oblong 12—15 mm. long, 4—5 mm. broad, apices obtuse, subcucullate, barbate. *Stamens* subequal, usually lanceolate, sometimes rather broadly expanded near the base. *Ovary* ovoid, style slender, twice as long as the ovary, stigma conspicuous, penicillate. *Capsule* short and broad, almost globose when fully developed. *Seeds*, black, flattish, semicircular.

Fl. Aug.—Nov.

*Hab.* Cape Province. Ceres Div.: Bet. Hottentots Kloof and Sutherland *Leipoldt* 3327. Laingsburg Div.: Hillandale, *Marloth* 9840. Clanwilliam Div.: N. of Pakhuis, *Esterhuysen* 5921A. Calvinia Div.: Botterkloof, *Esterhuysen* 3189, *Compton* 9643.

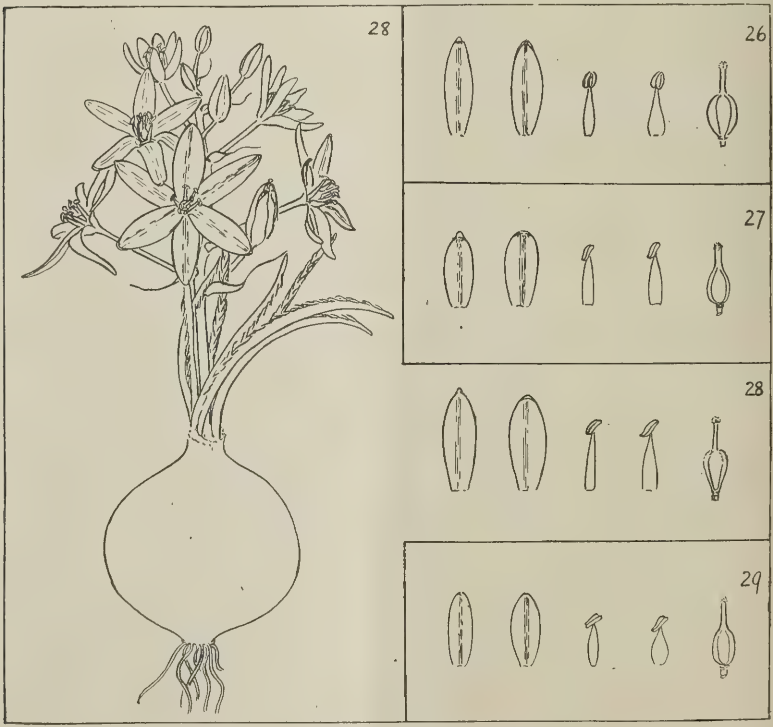
Var. **latifolium** *L. Bolus* in S.A. Gard. XXIV, 50 (Feb. 1934). *O. odoratum* Andr. Bot. Rep. t. 260.

*Hab.* Cape Province. Clanwilliam Div.: Between Piquetberg and Clanwilliam, *L. Bolus* in B.H. 20097 (*Type*); Between Clanwilliam and Lambert's Bay, *Lavis* in B.H. 22882. Van Rhynsdorp Div.: Klaver, *Lewis* in Nat. Bot. Gdns. 1858/32, *Marloth* 12549. Malmesbury Div.: Langebaan, *Lewis* in Nat. Bot. Gdns. 2030/32.

This variety differs from the usual form as understood above in having (1) more finely ciliate leaves which are often narrower and (2) taller laxer inflorescences with longer pedicels. [Fig. 25. Map V.]

26. **O. tortuosum** Bak. Fl. Cap. VI, 510.

Plants up to 15 cm. high, growing in clusters. *Bulb* ovoid or globose, about 1 cm. diam. with greyish membranous tunics. *Leaves* many, filiform, canaliculate, usually strongly sinuose, rarely almost straight, up to 5 cm. long, 0·5 mm. broad, margins ciliate when young, glabrescent



26. O. tortuosum. 27. O. nanodes. 28. O. Comptonii. 29. O. epigeum.
(All figures × 2).

with age. *Inflorescence* few-flowered, peduncle wiry, bracts membranous, cuspidate from a broad base, shorter than the pedicels. *Perianth-segments* pinkish-white with a median green stripe, 6—9 mm. long, 2 mm. broad, three outer segments subcucullate, all minutely barbate at the apex. *Stamens* more than half the length of the corolla, filaments gradually expanded from apex to base, three inner about twice as broad as the outer. *Ovary* ovoid, style and stigma as long as the ovary, stigma papillose.

Fl. Jan.

*Hab.* Cape Province. Mossel Bay Div.: Mossel Bay, *Salter* in Nat. Bot. Gdns. 1639/37.

[Fig. 26. Map. V.]

27. **O. nanodes** Leighton Journ. S.A. Bot. IX, 113 (July, 1943), (erroneously spelt *nannodes*); *O. pygmaeum* A. V. Duthie, Ann. Stell. Univ. VI, pt. 3, 2.

Plants 10—15 cm. high. *Bulbs* globose, 8—15 mm. diam. with a neck 15—20 mm. long. *Leaves* 6—12, linear, upper surface canaliculate, absent at the flowering time, 10—25 mm. long, 0·5—1 mm. broad, emerging in a rosette-like tuft from the neck of the bulb. *Inflorescence* few-flowered, flowers widely spaced, peduncle and pedicels wiry; bracts 2—6 mm. long apiculate; pedicels 2—3 cm. long, often arcuate. *Flowers* opening in the morning and closing in the afternoon. *Perianth-segments* whitish with a brown median stripe, oblong, 4—6 mm. long, 2 mm. broad, apices obtuse, incurved, barbate. *Stamens* almost as long as the perianth, filaments subequal, expanded gradually but not widely from apex to base. *Ovary* ovoid, style and stigma stout, shorter than the ovary. *Seeds* angled, surface granulate.

Fl. Nov.—Dec.

*Hab.* Cape Province. Stellenbosch Div.: Stellenbosch Flats, *Duthie* 1505 (*type*). Cape Div.: Ndabeni, Cape Flats, *Salter* 8597. Ceres Div.: N. end of Cold Bokkeveld Mts., *Leighton* 176; Karoopoort *L. Bolus* in B.H. 22870; Ceres Rd., *Schlechter* 9068. Van Rhynsdorp Div.: near Nieuwerust, *Esterhuysen* 1289; Leeuwfontein, *Pearson* in Sladen Mem. Exped. 3193.

[Fig. 27. Map V.]

28. **O. Comptonii** Leighton sp. nov.

Plantae alt. ad 7 cm. *Bulbus* globosus, albus, diam. 15—20 mm. *Folia* 5—7, canaliculata, glabra vel pilosa, long. 15—25 mm., lat. 1·5—2 mm., marginibus incurvis, setatis. *Inflorescentia* multiflora, globosa. *Perianthii segmenta* patentia. *Filamenta* subulata. *Ovarium* obovoideum. *Semina* angulata, granulata.

*Hab.* Cape Province. Laingsburg Div.: Karoo Garden, Whitehill, *Leighton* 269 (*Type*), *Compton* 3614. Prince Albert Div.: *Marchand* in Herb. Marloth 10504.

Plants up to 7 cm., usually about 5 cm. high. *Bulb* globose, white, 15—20 mm. diam. *Leaves* 5—7, arranged in a rosette, erect or suberect, glabrous or pilose, 15—25 mm. long, 1·5—2 mm. broad, upper surface deeply channelled and margins incurved with a fringe of downward-pointing setae; the leaves usually absent at the flowering time but remains often persisting. *Inflorescence* globose, 6—16-fld.; pedicels spreading, 1 cm. long. *Flowers* opening in the morning and closing early in the afternoon. *Perianth-segments* spreading, pale pinkish-brown, with a darker median stripe, outer 7—8 mm. long, 2 mm. broad, inner 6·5—7·5 mm. long, 2·5 mm. broad. *Stamens* subulate, 5 mm. high, three inner broader than the three outer. *Ovary* obovoid, narrowed considerably at the base, 3 mm. high, style and stigma slender, together 3 mm. high. *Seeds* black, angulate, granulate.

Fl. Sept.—Oct.

[Fig. 28. Map. V.]

29. **O. epigeum** Leighton Journ. S.A. Bot. IX, 110 (July, 1943).

Plants up to 36 cm. high. *Bulb* oblong-globose, up to 2 cm. diam., produced into a neck. *Leaves* numerous, vaginate at the base, narrow, wiry, up to 20 cm. long and 1 mm. broad. *Inflorescence* up to 30 cm. high, many-flowered. *Bracts* small, cuspidate. *Pedicels* slender, about 1 cm. long at flowering time, lengthening and becoming arcuate as the fruit develops. *Perianth-segments* whitish or cream with a greenish or brown median stripe on the under surface. *Stamens* about half as long as the perianth-segments, three inner filaments more widely expanded than the three outer. *Ovary* ovoid, 3 mm. long, style and stigma together 2 mm. long. *Seeds* black, angulate, rugose.

Fl. Oct.—Dec.

*Hab.* Cape Province. Laingsburg Div.: Karoo Garden, Whitehill, *Compton* 12629 (*Type*), 4082. Sutherland Div.: Driefontein, *Marloth* 9762. Little Namaqualand: Steinkopf, *Marloth* 13366.

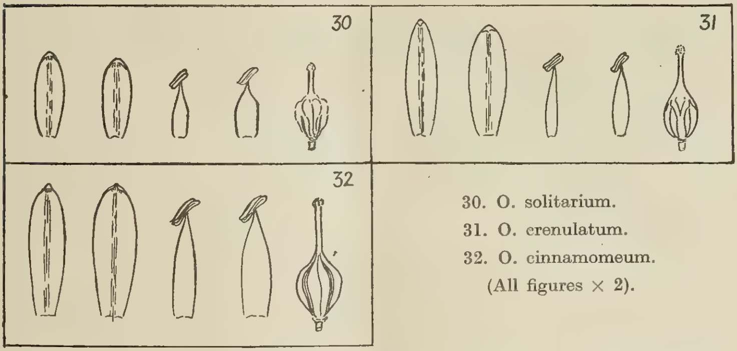
[Fig. 29. Map V.]

30. **O. solitarium** Leighton nom. nov. vice *O. unifolium* Dyer in Rec. Alb. Mus. IV, 111 (1930) non Retz.

Plants up to 10 cm., rarely more than 5 cm. above the ground. *Bulb* ovoid or globose, 1—3 cm. diam., outer tunics brown, leathery, continued upwards to form the neck 1—2 cm. long. *Leaf* solitary, oblong or lanceolate, glabrous, under surface often purplish in colour, 2—7 cm. long, 9—15 mm. broad, margins hyaline; leaves usually absent at the flowering time but remains may persist. *Inflorescence* few—many-fld. bracts papillose near the apices, as long as or longer than the pedicels. *Perianth-segments* whitish to brownish-yellow with a median green stripe, oblong 6—7 mm. long, 2—3 mm. broad, apices subcucullate, barbate. *Stamens* nearly as long as the perianth segments, filaments all expanded, 3 inner broader than the outer. *Ovary* ovoid or obconic, deeply lobed, lobes prominently keeled. *Seeds* angular, often compressed and elliptical, surface granulate.

Fl. Sept.—Oct.

*Hab.* Cape Province. Albany Div.: 6—7 miles from Grahamstown along the Cradock Road, in sand covering shale (Witteberg series), *Dyer* 2196 (*Type*). Laingsburg Div.: Karoo Garden, Whitehill, *Compton* 14654, 14589, *Leighton* 232. Prieska Div.: Prieska, *Bryant* 831, *Marloth* 13561. Griqualand West, Herbert Div.: Mazelsfontein, *Anderson* in B.H. 18644; St. Clair, *Anderson* 758. Kimberley Div.: Kimberley, *Marloth* 13414; Mauritzfontein, *Acocks*, in McGreg. Mus. 5758. Barkly West Div.: Holpan, Kalkveld, *Acocks* 2475, in McGreg. Mus. 5061.



30. O. solitarium.
31. O. crenulatum.
32. O. cinnamomeum.
(All figures × 2).

[Fig. 30. Map V.]

This species varies in the colouring of the flowers, in the degree of expansion of the stamens and in the nature of the keels or outgrowths of the ovary walls, but the differences are insufficient to warrant splitting it into two species.

31. **O. crenulatum** L. f. Suppl. 198. Thunb. Prod. 62; Fl. Cap. edit. Schultes, 315; Willd. Sp. Pl. II, 118; Roem. et Schultes VII, 529; Kunth Enum. IV, 371; Baker Journ. Linn. Soc. XIII, 278; Fl. Cap. VI, 515.

Plants 5—15 cm. high. *Bulb* ovoid or globose, 15—25 mm. diam.

outer tunics brown coriaceous. *Leaves* 2, patent, oblong, obtuse or subacute, 3—4 cm. long, 10—17 mm. broad, margins crenate, coarsely ciliate when young, rugose with age. *Inflorescence* few- or many-flowered, flowers rather crowded. *Perianth-segments* yellowish below, white above, 7—10 mm. long, apices hooded, 2·5—3 mm. broad. *Stamens* pilose lanceolate. *Ovary* narrowed slightly both at apex and base, deeply lobed, lobes sculptured, slightly canaliculate near the apex. *Capsule* broad, deeply lobed.

Fl. Oct.—Nov.

*Hab.* Cape Province. Riversdale Div.: Nr. Riversdale, *H. Bolus* in B.H. 22883 (without leaves); sine loc., *K. Muir* in B.H. 22884. Robertson Div.: Robertson, *de Villiers* in Nat. Bot. Gdns. 489/39 (leaves not seen).

*O. unifolium* Retz is cited as a synonym of *O. crenulatum* by Willdenow, Roemer and Schultes and by Kunth. [Fig. 31. Map V.]

32. **O. cinnamomeum** Leighton sp. nov.

Plantae alt. ad 30 cm. saepe 10 cm. *Bulbus* globosus, tunicis coriaceis. *Folia* 1—3, longo-ovata, apicibus obtusis, marginibus minute fimbriatis. *Inflorescentia* multiflora, conica. *Perianthii segmenta* albida et cinnamomea, angusta, apicibus cucullatis, barbatis. *Filamenta* plana, expansa. *Ovarium* obconicum, acute angulatum; stylus cum stigmate ovario aequilongo. *Semina* atra, plana, elliptica vel subdiscoidea.

*Hab.* Cape Province. Clanwilliam Div.: Roadside about 2½ miles S. of Clanwilliam, *Pillans* 9852, in Nat. Bot. Gdns. 639/43 (*Type*); Nardouw, *Stokoe* 8010, 8011.

Plants 10—30 cm. high. *Bulbs* globose 20—35 mm. diam. with leathery tunics. *Leaves* 1—3, long-ovate, 6—9 cm. long, 2—3 cm. broad, apex obtuse, no trace of leaves at flowering time, margin minutely fringed, undersurface purplish in colour. *Inflorescence* many-flowered, conical, peduncle bearing flowers for more than half its length. *Perianth segments* whitish on the upper, cinnamon or brownish on the under surface, 9—10 mm. long, 2—3 mm. broad and barbate at the apex. *Stamens* almost as long as the perianth, filaments gradually but broadly expanded from apex to base. *Ovary* obconic, deeply lobed with distinct ridges on the lobes. *Fruit* a broad, sharply angled capsule with many flat, black, elliptical or sub-discoid seeds.

Fl. Oct.—Nov.

This species is very close to *O. fuscatum* Jacq. but differs in the character of the ovary which is sculptured in Jacquin's figure, and in the nature of the leaves which are broader and prostrate in *O. cinnamomeum*. [Fig. 32. Map V.]

# PLANTAE NOVAE AFRICANAE.

"Ex Africa semper aliquid novi."—*Pliny*.

## SERIES XXIII.

By Professor R. S. Adamson, Miss W. F. Barker and Professor R. H. Compton.

**Hermannia rugosa** Adamson. (Sterculiaceae.)

*Caules* lignosi, ramosi, erecti vel decumbentes, strigosi. *Folia* rugosa, petiolata, inferiora oblonga, superiora obovata vel rhomboidea, 0.7—1.6 cm. longa, 0.4—1 cm. lata, apice dentata, basi plus minusve cuneata, petiolis laminis brevioribus, stipulis acutis basi latissime cordato-amplexicaulibus petiolis aequilongis vel paulo brevioribus. *Flores* binati vel ternati, penduli, pedunculis nudis. *Calyx* campanulatus, submembranaceus, lobis distantibus acuminatis vel cuspidatis tubo brevioribus. *Petala* lutea, 0.8—1 cm. longa, calyce duplo longiora. *Filamenta* latissime obovata, 3 mm. lata, marginibus appressis excurvatis. *Fructus* obovoideus calyce longior.

Allied to *H. Preslyana* Turcz. and to *H. prismatocarpa* E. Mey. ex Harv. but differing from both in the leaf, stipules, calyx, very wide filaments and in the fruit.

*Hab.* Cape Province. Cape Div. Newlands, *Salter* 8772 (type in Hb. Bolus), 8669, 8900; Green Point Common, *Salter* 8780; *Adamson* 2511, 2922, 3526; Blaauwberg, *Pillans* 8621 (as *H. Preslyana* Turcz.); Tigerberg, *Pillans* 4701 (as *H. prismatocarpa* E. Mey.). Malmesbury Div. Kalabas Kraal, *Gillett* 4162; Hoetjes Bay, *Bolus* 12619 (as *H. prismatocarpa* E. Mey.); Moorreesberg, *Bolus* 9948 (as *H. Preslyana* Turcz.). Piquetberg Div. Rest Mt., *Gillett* 3731.

**Hermannia micrantha** Adamson nom. nov. (Sterculiaceae.)

My attention has been called to the fact that the name *Hermannia intricata* Adamson (*Journ. S. Afr. Bot.* 7. 198, 1941) is not valid, having been already used for a species from Great Namaqualand, *H. intricata* Engl. (Engl. Bot. Jahrb. 55, 366, 1919). For the Cape Peninsula species the new name *H. micrantha* Adamson is proposed.

**Cotula montana,** Compton. (Compositae-Anthemideae.)

Planta herbacea, perennis, acaulis, stolonifera. *Folia* molliter membranacea, longe petiolata, 1—2-pinnatisecta, pilosa, lobis oblongis, subacutis. *Stolones* epigei, foliis paucis, parvis, pinnatisectis, caducis. *Pedunculi* scaposi, pauci, angusti, elongati, teretes, pilosi. *Capitulum* solitarium, expansum. *Involucri bracteae* paucae, subbiseriatae, herbaceae, pilosae, marginibus scariosis, lobulatis, fuscis. *Radii flosculi* 5, ligulati, albi, feminei, brevipedicellati, ligulis perobtusis : *disci* numerosi, tubulati, parum compressi, flavi, hermaphroditi, lobis 4, erectis. *Achaenia* plana, glabra, epapposa.

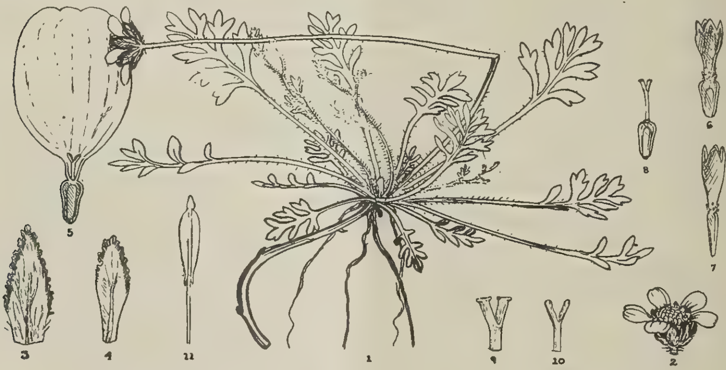


Fig. 1. *Cotula montana*. 1. Plant, nat. size. 2. Capitulum, nat. size. 3, 4. Outer and inner involucral bracts × 4. 5. Ray floret × 4. 6. 7. Disc florets, radial and tangential view × 4. 8. Disc floret with corolla and stamens removed × 4. 9, 10. Stigmas of disc and ray florets × 16. 11. Stamen of disc floret × 16. (*Compton* 10108.) *Del.* M. Walgate.

*Hab*. Cape Province. Ceres Division : Bokkeveld Tafelberg, 1,800 m., 8 December, 1940, *Compton* 10108 (*Type*, in Herb. Nat. Bot. Gdns.) ; same locality and date, S.E. slopes, overhanging rock-shelter, 1,800—2,000 m., *Esterhuysen* 3978 ; same locality, 2,050 m., 22 January, 1897, *Schlechter* 10097. Clanwilliam Division : Langberg (Cederberg), rock-shelter, 2,000 m., 15 December, 1941, *Esterhuysen* 7325 ; same locality and date, 2,050 m., *Bond* 1384 ; peak south of Sneeuwkop (Cederberg), rock-shelter, 1,600—2,000 m., 2 January, 1942, *Esterhuysen* 7548.

Herbaceous, perennial, stoloniferous. *Leaves* softly membranous, basal, spreading, crowded on a very short stem, very varied in size, up to 5 cm. long × 2 cm. wide, petiole as long as or longer than lamina, pilose throughout with long soft spreading hairs, lamina 1—2-pinnatisect,

ultimate lobes oblong, sub-acute, midrib and marginal veins distinct. *Stolons* slender, spreading, bearing a few short pinnatisect leaves which soon fall off, rooting and producing new plants at their tips. *Peduncles* only 1 or 2 per plant, slender, terete, leafless, pilose throughout, up to 12 cm. long, usually less, without terminal enlargement. *Capitulum* solitary, widely expanded. *Involucral bracts* sub-biseriate, few, lanceolate, sub-obtuse, green, herbaceous, pilose, with a distinct midrib and a dark lobulate scarious margin and apex, the largest 5 mm. long × 2 mm. wide. *Ray florets* 5, ligulate, female, shortly pedicellate, the corolla spreading, broadly obovate, very obtuse, slightly lobed, veined, white on both surfaces, c. 9 mm. long × 5 mm. wide. *Disc florets* numerous, hermaphrodite, tubular, the tube slightly flattened with a few glands near the base, lobes 4, erect, yellow. *Achenes* flat, margined, glabrous, without pappus.

This very distinct new Cotula has been collected on two or three mountain summits in the Western Cape Province at altitudes above 1,600 m., where it occurs in rock shelters not exposed to full sun. It is one of the few species of Cotula (sens. lat. incl. Cenia) with ligulate ray florets, which give it rather the appearance of a rayed Matricaria. The stolons are a striking feature : they bear a few small leaves which soon fall off. New plants are produced at the tips of the stolons which persist for a time, linking parent with daughter plants.

**Iphiona integra,** Compton. (Compositae-Inuleae.)

Fruticulus glaber, divaricate ramosus. *Caules* parum angulares. *Folia* numerosa, patentia vel erecto-patentia, subenervia, anguste lineare-oblanceolata, base attenuata, apice breviter mucronata. *Capitula* solitaria, terminalia, late campanulata, discoidea. *Involucri bracteae* numerosae, multiseriatae, gradatae, erectae, lineares, scariosae, carinatae, acutae, marginibus leviter fimbriatis. *Flosculi* plurimi, tubulati, involucrum multo excedentes. *Achaenia* sericeo-pilosa. *Pappi setae* paucae, plus minusve inaequales, barbellatae, setis exterioribus brevibus, anguste squamosis, circumdatis. *Stylus* longe exsertus. *Antherae* caudatae.

*Hab.* Cape Province. Ladismith Division : Seven Weeks Poort, 8 December, 1939, *Thorns* s. n. (*Type*, in Herb. Nat. Bot. Gdns.).

A small divaricately branching shrub, glabrous throughout. *Stems* slightly angular. *Leaves* numerous, spreading or erecto-patent, entire, membranous, narrowly linear-oblanceolate, tapering to base, tipped with a small conical mucro, midrib inconspicuous, up to 1.5 cm. long × 2 mm. wide, gradually becoming smaller upwards and passing into the basal involucral bracts. *Capitula* solitary, terminal, broadly campanulate, up to 1.8 cm. long, 2.5 cm. diam. *Involucral bracts* very numerous, multiseriate, graded from very small bracts on the neck-like peduncular portion of the stem to the innermost bracts up to 9 mm. long, erect, linear, scarious, carinate, acute, margins shortly fimbriate. *Florets* numerous, tubular, much exceeding the involucre, 1.2 cm. long. *Ovary* silky-hirsute. *Pappus setae* few, often unequal, the longest 9 mm. long, finely barbellate, with a few external shorter narrow scales or hairs. *Corolla* yellow, tube 10 mm. long, lobes 1 mm. long, reflexed. *Anthers* shortly exserted, long-tailed. *Style* finally long-exserted with long revolute stigmas.

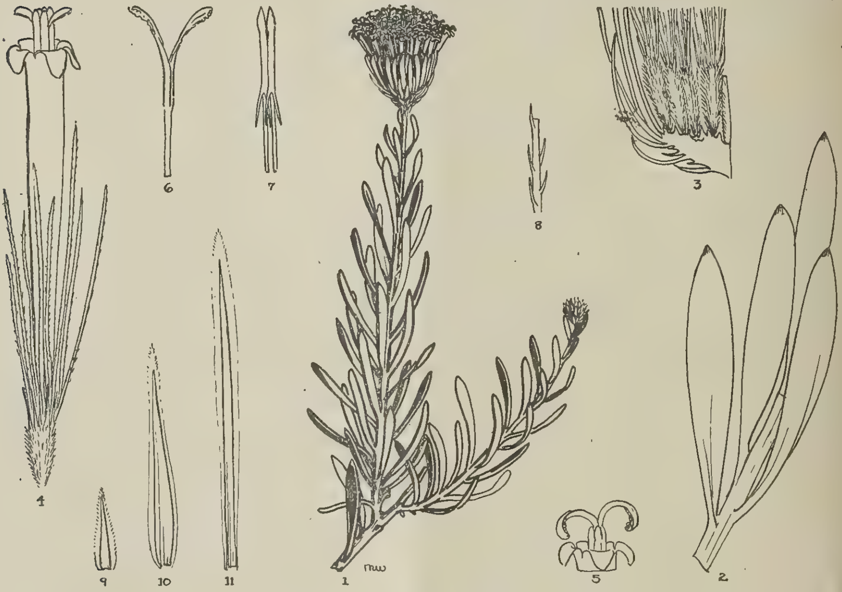


FIG. 2. *Iphiona integra.* 1. Plant, nat. size (the capitulum drawn is rather a small one). 2. Stem and leaves × 3. 3. L. S. capitulum × 5. 4. Young floret × 5. 5. Tip of older floret × 5. 6. Stigma × 5. 7. Stamens × 5. 8. Part of pappus bristle × 20. 9, 10, 11. Lower, median and inner involucral bracts × 5. (*Thorns* s. n.) , *Del.* M. Walgate.

Related to *I. dentata* Bolus from the Montagu district, differing mainly in its entire leaves, those of *I. dentata* being pinnatisect.

**Senecio Hollandii,** Compton. (Compositae-Senecioneae.) § Rigidi.

Frutex lignosus. *Rami* divaricati, flexuosi, albo-lanati. *Folia* coriacea, petiolata, ovata, acuta, crenato-dentata, supra maturitate glabra subnitentia, infra persistente albo-lanata, marginibus parum reflexis. *Inflorescentia* compacta, corymbosa, pedunculis lanatis. *Involucri bracteae* c. 8, oblongae, glabrescentiae. *Radii flosculi* c. 5, ligulati, flavi, *disci* c. 20. *Achaenia* striatula, glabra. *Pappi setae* albae, molliter sericeae, caducae.

*Hab.* Cape Province. Uitenhage Division: Near Bulk River Reservoir, September, 1931. *F. H. Holland* 3654 (*Type*, in Herb. Bolus.). Laingsburg Division: Witteberg (Whitehill section), 1,600 m., 2 July, 1942, *Compton* 13287 (in Herb. Nat. Bot. Gdns.).

Shrubby. *Branches* divaricate, more or less flexuous, terete, white-woolly. *Leaves* numerous, alternate, spreading, petiole 5—8 mm. long, lamina coriaceous, from a cuneate base ovate, acute, the margin slightly reflexed, shortly dentate with rounded sinuses between the teeth which are shortly apiculate, upper surface lanate when young, quickly glabrescent, almost glossy, lower surface persistently closely white-woolly, the midrib glabrescent, 1.0—2.5 cm. long, 0.8—1.5 cm. wide. *Inflorescence* a rather compact terminal corymb, capitula not very numerous. *Peduncles* and *involucres* white-woolly. *Involucre* of about 8 bracts, 4 mm. long, oblong, sub-acute, with narrow scarious ciliolate margins, calycles few. *Ray florets* about 5, ligular, yellow, about 8 mm. long. *Disc florets* about 20, about 4 mm. long. *Achenes* terete, somewhat striate, glabrous, light brown, c. 3 mm. long. *Pappus* soft, white, silky, caducous.

Unusually woody for a South African Senecio and not closely related to any other species. The distribution is remarkable, the two known localities being more than 250 miles apart. The Witteberg plant has only been observed in one small area among rocks near the summit of the range: the specimens had passed flowering and, as is to be expected, were dwarfed and had smaller leaves than the Van Stadensberg specimens which I have taken as the type; but the identity of the two gatherings cannot be doubted. It is most likely that records will later be obtained from intervening localities. It may be remarked that the Witteberg flora has very little relationship in the eastward direction, its general affinities being with the north-west.

**Stilbe rupestris,** Compton. (Verbenaceae-Stilbeae.)

Fruticulus humilis. *Caules* subflexuosi, molliter pubescentes. *Folia* juventute sericeo-pubescentia, glabrescentia, demum patentia vel deflexa, 2—4-nata, base articulata, linearia, obtusa vel subapiculata, marginibus reflexis. *Flores* in apicibus aggregati. *Bractea bracteolaeque* naviculaeformae, marginibus reflexis. *Calyx* profunde 5-partitus, lobis acuminatis, pubescentibus. *Corolla* alba, praeter intus in segmentorum basibus glabra, segmentis tubo longioribus, lanceolatis, subacutis. *Stamina* 4, corollae in faucibus inserta, antheris manifestis. *Ovarium* breviter stipitatum, 2-ovulatum, stigmate exserto.

*Hab.* Cape Province. Caledon Division: In small rock fissures in Table Mountain Sandstone ridges between Palmiet and Steenbras Rivers, near Grabouw, 24 April, 1943, *Compton* 14492 (*Type*, in Herb. Nat. Bot. Gdns.), *Leighton* 475; rocky cliffs near Marine Hotel, Hermanus, November, 1921, *Rogers* in Herb. Bolus 14205; mountains between Palmiet River and Kleinmond, April, 1926, *Stokoe* s. n.; Kogelberg area on rocks, common, April, 1931, *Stokoe* 2570; hills north of lower Steenbras River, 19 January, 1934, growing in crevices of boulders, *Salter* 4253; Palmiet River Valley, January, 1943, *Stokoe* 8752.

A small shrublet, branched from the base, the stems seldom more than 10 cm. long, slender, erect or flexuous, softly pubescent. *Leaves* erect and silky-pubescent when young, glabrescent, spreading or deflexed when older, densely arranged in whorls of 2—4, each jointed at the base on a shortly decurrent pulvinus, linear, obtuse or sub-apiculate, margins closely reflexed against the midrib below, 5—9 mm. long, 1.0—1.5 mm. wide. *Flowers* numerous, sessile in a compact terminal cluster c. 1 cm. diam. *Bract* 5—6 mm. long, boat-shaped, green, acute, hairy at the base outside, the margins reflexed as in the leaves. *Bracteoles* 2, similar to the bract, c. 3 mm. long. *Calyx* deeply 5-cleft, c. 3 mm. long, one segment slightly shorter and narrower than the others, softly hairy, acuminate. *Corolla* glabrous except for a patch of hairs at the base of each lobe inside, tube straight, c. 4 mm. long, lobes flat, white, lanceolate, spreading, sub-acute, c. 5 mm. long. *Stamens* 4, inserted at the throat of the corolla, filaments c. 4 mm. long, anthers exposed. *Ovary* shortly stipitate, 2-ovulate. *Style* slender, c. 7 mm. long, stigma minute, exserted.

Well distinguished by its small stature, related to its special habitat in rock-crevices with very little soil. It agrees with *S. phylicoides* A. DC. and *S. mucronata* N.E.Br. in its deeply cleft calyx: from *S. mucronata* it differs in the less degree of hairiness of the stem, bract, bracteoles, calyx and corolla, and the longer filaments and style; from *S. phylicoides* (which has a much more easterly distribution in the Langeberg) in the hairy sepals, the longer corolla lobes and style; and from both in the smaller stature and the shape and attitude of its leaves.

**Myrica diversifolia** Adamson (Myricaceae).

Frutex erectus, ramosus, caulibus junioribus hirsutis tandem glabris. *Folia* coriacea, breviter petiolata, elliptica vel obovata, acuta, glabrescentia, inferiora integra, superiora repando-serrata, serratulis obtusis ascendentibus, nervis pallidis, distincte reticulatis. *Amenta* dioica; mascula elongata, bracteis latis ciliatis medio glandulosis, stamina aequilongis; foemina multo breviora, pauciflora. *Stamina* 4, raro 2 vel 6, filamentis perbrevibus. *Styli* longi exserti. *Fructus* sphaericus.

Not infrequent on sheltered mountain slopes and at the margins of peaty swamps. Fl. Aug.–Sep.

*Hab.* Cape Province. Cape Peninsula: Devil's Peak, *Zeyher*; Table Mt., *Levyns* 1085; Kalk Bay Mts., *Adamson* 3376; *Levyns* 1086, 1087, 1088; Silvermine Valley, *Levyns* 1094; Klaver Valley, *Levyns* 5636; Modderdam, *Adamson* 3325, 3345, 3368 (type in Herb. Bolus); *Salter* 8691; Smitswinkel, *Adamson* 3321, 3366; *Isaac* (in Herb. Bolus 22583).

An erect shrublet not unlike *M. Zeyheri* C.DC. *Leaves* elliptical or obovate, 1.5—3 cm. long, 0.7—1.3 cm. wide, the lower entire, the upper with large obtuse forwardly directed teeth, the veins pale-coloured, translucent in the fresh state, forming a distinct network. *Male catkins* 1—2.5 cm. long, *female* about 4 mm. long and inconspicuous with 1—3 flowers.

The plant is often associated with *M. humilis* Ch. & Sch. or with *M. Zeyheri* C.DC., less often with *M. quercifolia* L. In such situations forms intermediate in leaf and other characters between the species are to be found. These intermediates which can sometimes be arranged as a complete chain, are regarded as of hybrid origin.

This species is named with a certain degree of hesitation. It agrees in many features with the description of *M. incisa* Chev. Mon. Myric. 150, 1901, though that species is stated to have leaves reddish on the underside and scarcely reticulate veins.

*M. incisa* was based upon the figure in Burm. Rar. Afr. Pl. 262, t. 98, f. 1, 1738. However, Burmann himself states that his plant is the same as that described in Hort. Cliff. 456, 1737, which Linnaeus quotes as his first reference under *M. quercifolia* (Sp. Pl. 1025, 1753). Burmann's figure and that of Pluckenet (Amal. 65, t. 424, f. 4), also referred to by Linnaeus, might possibly represent this species. Both are of a different plant from that figured in Pluck. Amal. t. 424, f. 9, and in Commel. Hort. Amst. 2, 161, f. 81, which represent the plant commonly referred to *M. quercifolia* L. The latter figure is quoted by Linnaeus (l.c.) but not the former.

None of the figures mentioned show the venation which is the most obvious diagnostic feature. As the original specimens cannot at present be consulted, and as both species exhibit variation in leaf-form which makes identification by figures almost impossible, the new name has been applied to a species which forms a distinct unit worthy of separate recognition even though it may be found that it is not valid under a strict application of the rules governing type specimens.

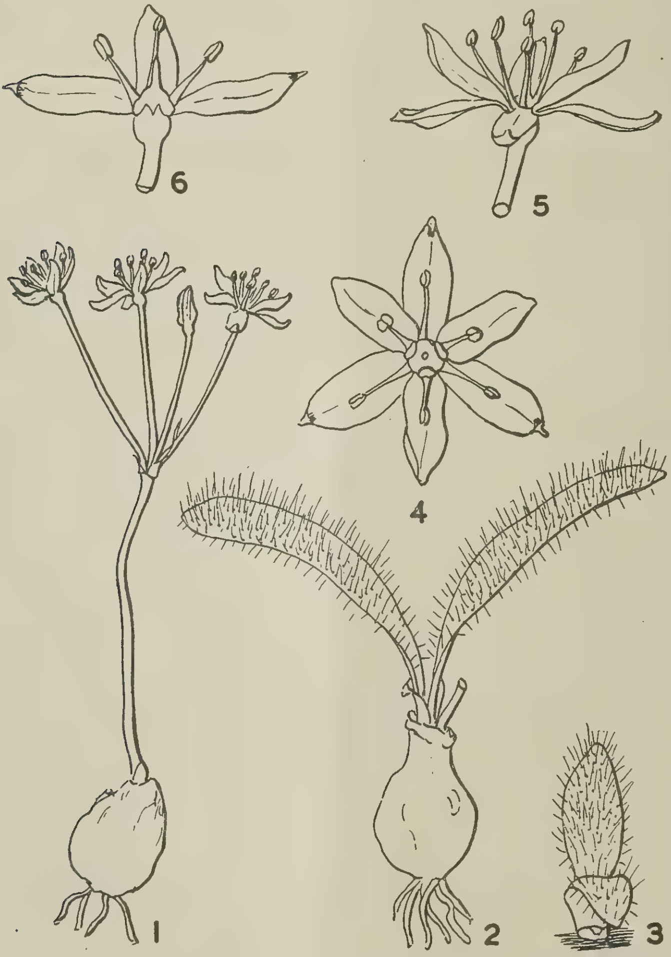


FIG. 3. *Hessea Chaplinii.* 1. Bulb in flowering stage × 1. 2. Bulb with leaves produced × 1. 3. Young leaves emerging from bulb × 1. 4. Flower from above × 3. 5. Flower side view × 3. 6. Longitudinal section of flower × 3. (*Chaplin* 9, Nat. Bot. Gdns. 154/44.) *Del.* W. F. Barker.

**Hessea Chaplinii** Barker. (Amaryllidaceae.) § Imhofia.

*Bulbus* oblongo-globosus, in collum plus minusve productus. *Folia* 2, hysterantha, obovata-oblonga, obtusa, suberecta vel expansa, supra papillis minutis pilis longis sericeis praefixis. *Umbella* ad 8-florata. *Perianthii segmenta* e base expansa, alba, carinis rubidis. *Stamina* quam perianthium parum breviora, biverticillata, ad styli basim adnata. *Stylus* basi dilatus, demum staminibus aequilongus. *Ovarium* globosum.

*Hab.* Cape Province. Malmesbury Division : Langebaan, *Chaplin* 9, Nat. Bot. Gdns. 154/44. (*Type*, in Herb. Nat. Bot. Gdns.) Flowers 15th March, leaves 10 May, 1944.

Bulb oblong-globose, up to 2 cm. long, 1.5 cm. diam., covered with dark brown tunics usually produced into a short neck which may reach 3 cm. in length. *Leaves* 2, hysteranthous, emerging at flowering time through a white membranous sheath, sub-erect or spreading, narrowly obovate-oblong, obtuse, back of leaf quite glabrous, shading to purple at base, upper surface and margins with numerous minute papillae each tipped with a silky hair up to 4 mm. long, blade finally 5 cm. long and 1 cm. broad near apex. *Umbel* up to 8-flowered. *Peduncle* apparently shorter in the wild state but reaching 12 cm. in cultivation, green or tinged with red ; pedicels up to 4 cm. long, green or tinged with red. *Spathes* 2, papery, purplish, up to 1.5 cm. long. *Perianth* white with reddish keels ; segments spreading from the base, up to 6 mm. long, 2 mm. broad. *Stamens* a little shorter than the perianth ; filaments adnate to the base of the style. *Style* finally nearly as long as the stamens, base swollen. *Ovary* globose, 1.5 mm. diam.

This plant is at present only known to occur at Langebaan, where it was collected by James Chaplin of the Royal Air Force, after whom it is named. It seems to be most closely related to *H. gemmata* Benth., but in that species the peduncle is taller, the leaves are longer and narrower and not so silky, and the flowers appear to be a creamy-yellow colour. It differs from *H. Leipoldtii* Bolus in having smaller leaves with the long hairs covering the surface and not confined to a fringe on the margins.

**Strumaria Salteri,** Barker. (Amaryllidaceae.)

*Bulbus* oblongo-globosus, in collum breviter productus. *Folia* 2—3, hysterantha, oblanceolata, acuta, suberecta vel expansa, marginibus minute ciliatis. *Umbella* 5—10-florata. *Perianthii segmenta* rosea, breviter unguiculata, e base gradatim expansa. *Stamina* quam perianthium parum breviora, biverticillata, ad styli basim adnata, *Stylus* angustus. *Stigma* minute trilobatum. *Ovarium* globosum.

*Hab.* Cape Province. Clanwilliam Division : Pakhuis, *Salter* 7508 and Nat. Bot. Gdns. 986/38. (*Type*, in Herb. Nat. Bot. Gdns.) Leaves

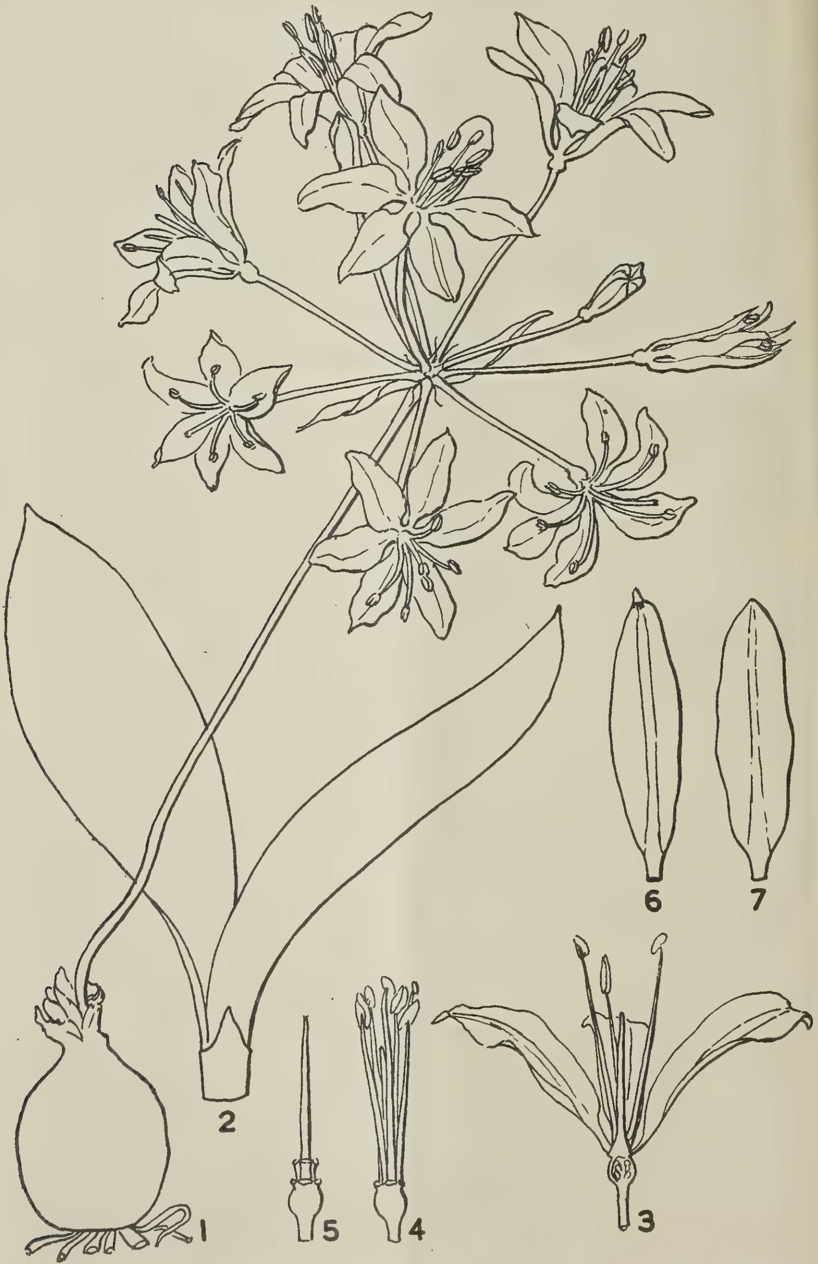


FIG. 4. *Strumaria Salteri.* 1. Bulb in flowering stage × 1. 2. Leaves with base enclosed in sheath × 1. 3. Longitudinal section of flower × 1½. 4. Androecium and gynaecium × 1½. 5. Gynaecium × 1½. 6. Outer , perianth segment × 1½. 7. Inner perianth segment × 1½. (*Salter* 7508 and Nat. Bot. Gdns. 986/38.) *Del.* P. Kies and W. F. Barker.

4 Sept., 1938, and 9 June, 1944; flowers 16 April, 1940, and 2 May, 1944. Calvinia Division: Between Van Rhynsdorp and Calvinia, *Leipoldt*, Nat. Bot. Gdns. 32/40. Leaves 9 June, 1943 and 1944, flowers 20 April, 1943, and 2 May, 1944.

*Bulb* oblong-globose, 2.7 cm. long, 2.2 cm. diam., covered with brownish tunics produced into a short neck. *Leaves* 2—3, hysteranthous, emerging from a sheath with an acute green cusp, sub-erect or spreading, blade green and shining, oblanceolate-acute, shorter and broader in the wild state, in cultivation up to 7 cm. long, 2.5 cm. broad, margins minutely ciliate. *Umbel* 5—10-flowered. *Spathes* 2, papery, dark reddish purple, up to 2.2 cm. long. *Peduncle* bent at base so that inflorescence leans at an angle to the ground, tinged with red-purple, 10—14 cm. long. *Pedicels* reddish purple, up to 4.7 cm. long. *Perianth* rose-pink with a deeper central stripe, especially on the back towards the base, shortly clawed, spreading gradually from the base with the upper half gently recurved, 2 cm. long, up to 6 mm. broad. *Stamens* a little shorter than the perianth, adnate to the base of the style; filaments slender, anthers dark red, 3 mm. long before pollen is shed. *Style* finally as long as stamens; stigma minutely 3-lobed. *Ovary* globose, 2 mm. diam.

Captain T. M. Salter first collected this charming Strumaria in the Pakhuis Pass in September, 1938. His specimens were in leaf and a bulb in this condition was preserved, the leaves being shorter and broader than those subsequently produced in cultivation.

It is most nearly related to *S. Watermeyeri* L. Bolus but is a more striking plant, being larger in all respects. The flowers are a deeper pink with the segments wider in proportion, more spreading and with a shorter claw, the stamens are a little shorter than the perianth and the leaves are minutely ciliate on the margins, not with minute glutinous papillae towards the margins as in that species.

**Anthericum congestum** Adamson (Liliaceae-Asphodeleae).

*A. hispido* affinis sed differt caulibus subcaespitosis; tuberis pyriformibus; foliis canaliculatis, apice subteretibus, infra carinatis, vix striatis; squamis longioribus, subacutis; racemis congestis, haud elevatis, pedunculo subterraneo; bracteis dense hirsutis et fructibus minoribus.

Seasonally wet gravelly or stony flats in the Cape Peninsula. Fl. July–Sep.

*Hab.* Cape Province. Cape Peninsula: Lion's Head, *Zeyher* 4246; Rondebosch, *Bolus* 3731 (p.pte.); Newlands, *Wolley-Dod* 533; Claremont, *Salter* 8767 (type in Hb. Bolus), *Page, Adamson* 3498, 3575; Fish Hoek *Adamson* 2894; Kommetje, *Adamson* 2557.

In dense tufted groups often associated with numerous young plants with bulbil-like tubers. Main *tubers* 2—3, broadly pyriform, 1.5—1.8 cm. diam., abruptly narrowed at the tip. *Scale leaves* 1.5—3, commonly 2—2.5 cm. long, suddenly narrowed to an acute tip. *Leaves* sprawling, often glabrous, 20—30 cm. long, channelled above, rounded below and keeled in the lower half, scarcely striate, 0.4—1 cm. wide at the base, subterete towards the tip. *Raceme* dense, corymbose, at ground level and not raised at the fruiting stage. *Peduncle* below ground, 3—12 cm. long. *Bracts* densely hairy, not distinctly ciliate. *Flowers* greenish or yellowish externally, open all day. *Fruit* spherical, 3 mm. diam.

Not hitherto separated from *A. hispidum* L. Bolus & Wolley-Dod (Trans. S. Afr. Phil. Soc. 14, 341, 1903) appear to have been the first to suspect that it is distinct from *A. hispidum*. They seem to have been especially impressed by the elongated peduncle and quote three specimens, collected by *Wolley-Dod*, as " forma *elongata* " : of these specimens 533 is this species, 534 is *A. hispidum* L, and 535 is *A. longepedunculatum* Steud. *Bolus* 3731 consists of two gatherings made at different times ; one sheet (in Hb. Bolus) from Rondebosch is this species, another collected earlier near Cape Town, is *A. hispidum* L.

**Urginea pedunculata** Adamson. (Liliaceae-Scilleae).

*Bulbus* subsphaericus, 3—5 cm. diam., tunicis imbricatis, externis castaneis, teneris, interioribus albis, 2 vel 3 in vaginas pallidas membranaceas productis. *Folium* unicum, teres, hysteranthum. *Scapus* erectus, 40—60 cm. altus. *Racemus* congestus, 2—2.5 cm. longus. *Bracteae* parvae, 1 mm. longae, in calcarem 4 mm. longum productae. *Pedicelli* 3 mm. longi. *Perianthii segmenta* 6 mm. longa, fere totius libera, interiora subcucullata. *Stamina* distincte epipetala, antheris filamentis aequilongis. *Ovarium* trigonum, stylo aequilongum.

*Hab.* Cape Province. Cape Peninsula : Sheltered slopes at 1,000 ft. on the Kalk Bay mountains. Fl. Dec. *Adamson* 3483 (coll. M. R. Levyns) type in Herb. Bolus.

A distinctive species well characterised by the spherical bulb, absence of a barred sheath, hysteranthous leaf, long peduncle, small flowers in a crowded raceme and the distinctly epipetalous stamens.

**Pentaschistis silvatica** Adamson (Gramineae-Aveneae).

Perennis laxe caespitosa. *Culmi* trinodii, 40—60 cm. alti, internodiis vaginis longioribus. *Vaginae* hispidae, pilis longis patentibus, in marginibus numerosis ceteris paucis. *Lamina* glabra, plana vel superne subcanaliculata, 3—4 mm. lata ; ligula longe pilosa. *Panicula*

laxa, ramis ternatis quaternatisve, subglandulosis, axillis hirsutis. *Spiculae* 7—8 mm. longae, pallidae vel luteae. *Glumae* submembranaceae, acuminatae, basi virides vel purpuratae, basi breviter trinerviae vel superior etiam 5-nerviae, minutissime hirsutae, carina glandulosa. *Lemmata* 4—5 mm. longa, 9—11-nervia, pilosa, lobis lateralibus oblique acuminatis, apice liberis, setulis 3 mm. longis glumis vix aequantibus. *Lodiculi* glabri, truncati. *Ovarium ovoideum* inter stylos minute apiculatum.

Margins of indigenous forests on the east side of Table Mt. Fl. Nov.

*Hab.* Cape Province. Cape Peninsula: Kirstenbosch at 1,100 ft. *Adamson* 3442 (type in Herb. Bolus).

In appearance like *P. natalensis* Stapf but differing in the larger spikelets, eglandular glumes 3-nerved at the base, the less hairy lemmas with more slender bristles and less completely adnate lobes. From *P. capensis* (Nees) Stapf it is distinguished by the habit, the hairy sheaths, 3-nerved glumes, the smaller bristles and shorter lobes of the lemmas.

# SOME NEW SPECIES AND VARIETIES IN THE GENUS HAWORTHIA. III.

(With Plate IV.)

By G. G. Smith.

**Haworthia Beanii,** G. G. Smith. (Liliaceae-Aloineae) Sect. Trifariae.

*Caulis foliatus* longus 8 cm., latus una cum foliis 65 mm.

*Folia* tortuose trifaria, imbricata, longa 42 mm., lata 18½ mm., longe recurvata ; *supra* concava, parte 1⅓ superiore minute scabrosa arenosaque.

*Pedunculus* simplex, longus una cum racemo 27 cm., diam. vix 1 mm. ; *racemus* longus 9—10 cm., floribus gemmisque circiter 14 ornatus ; *pedicelli* longi 4½—5 mm., diam. ½ mm. claro-fusci ; *bracteae steriles* 3, longae 5½ mm. ; *bracteae fertiles* longae 2½ mm. ; *perianthium* opaco-album, longum 15—16 mm. ; *ovarium* longum 2½ mm., diam. vix 1¼ mm. ; *stylus* longus 1½ mm.

*Leafy stem* erect, 8 cm. long, 65 mm. across including the leaves, proliferous from the base.

*Leaves* spirally trifarious, imbricated, spreading, 42 mm. long, 18½ mm. broad below the middle, 5½ mm. thick, the sheathing leaf base 6 mm. long on opposite side to the lamina, ovate-elliptic, acute-acuminate, cuspidate, long recurved ; *face* concave, recurved towards the tip at an angle of about 80 degrees, minutely scabrous and sandy in the upper ⅓, with about 6 lines, pink near base, dark green above becoming reddish towards the tip ; *back* rounded, triangular towards the tip, minutely scabrous and sandy in the upper ¾, with about 14 lines, pink near base, dark green above becoming reddish-brown near tip ; *keel* 1, in the upper ½, central, obtuse below, acute and conspicuously raised towards the tip ; *margins* acute in the lower ⅓, blunt above, reddish-brown.

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KEY TO THE DRAWINGS.

F=Leaf face.
LS=Longitudinal section.
SB=Section near base.
INF=Inflorescence.
O & S=Ovary and Stamens.
C=Capsule.

B=Leaf back.
SM=Section near middle.
ST=Section near tip.
Del. M. C. L.=Drawn by Miss M. Courtenay-Latimer.

*Peduncle* simple, terete, barely 1 mm. diam., 27 cm. long including the raceme, dark reddish-brown below; *raceme* 9—10 cm. long, with about 14 spirally arranged flowers and buds, 1—2 open simultaneously; *pedicels* 4½—5 mm. long, ½ mm. diam., ascending, light brown; *sterile bracts* 3, 5½ mm. long, the lowest 6 cm. from base of peduncle; *fertile bracts* 2½ mm. long, deltoid, acuminate-subulate, light brown with a fine dark brown nerve; *perianth* dull white, 15—16 mm. long, the cylindrical-hexagonal sub-globose base 3 mm. diam., only slightly constricted above, tapering to pedicel, oblong, ± ascending, hardly curved; *upper segments* obtuse, channelled, the inner recurved about 50 degrees, face colour white with a broad green nerve, the 2 outer recurved about 90 degrees, ± spreading, face colour white with a fine brown nerve; *lower segments* obtuse, the inner ± channelled, very recurved, face colour white with a medium fine brown nerve, the 2 outer replicate below, channelled above, very recurved, shorter than the inner, spreading, face colour white with a fine greenish-brown nerve; *stamens* 5½ and 6 mm. long; *ovary* 2½ mm. long, barely 1¼ mm. diam., dull green; *style* 1½ mm. long, yellowish-green, straight, ± capitate.

*Habitat*: Cape Province: Humansdorp District (Type, *G. G. Smith* 3189, in East London Museum Herb.; co-types in Nat. Bot. Gdns. Herb., Kirstenbosch; Nat. Herb., Pretoria).

*Distribution*: not further known.

This interesting species was collected by Miss M. Courtenay-Latimer in March, 1940, on the farm Ferndale, about 6 miles N.E. of Patentie, on rocky slopes facing north. The locality was pointed out by the owner of the farm, Mr. Guy Bean, who remembered seeing the plants growing many years ago, before he lost his sight, and for whom the plant is named. It is, like *H. cordifolia* Haw., the largest of all the known species and varieties in the Sect. Trifariae. It is, however, easily distinguished from *H. cordifolia* by its longer and spirally arranged leaves.

**Haworthia Beanii** var., **minor** G. G. Smith. (Liliaceae-Aloineae.) Sect. Trifariae.

*Caulis foliatus* sub-erectus, longus usque ad 8 cm., latus una cum foliis 42 mm.

*Folia* tortuose trifaria, longa 22 mm., lata 14 mm., crassa 4 mm.; *supra* concava, minute scabrosa; *subtus* convexa, minute scabrosa.

*Pedunculus* simplex, diam. ½ mm., longus 25½ cm. una cum racemo longo 7 cm.; *pedicelli* longi 7 mm., diam. ½ mm.; *bracteae steriles* 2, longae 4 mm.; *bracteae fertiles* longae 3½ mm.; *perianthium* album, longum 18 mm.; *stamina* longa 5—6 mm.; *ovarium* longum 3 mm., diam. 1¼ mm.; *stylus* longus vix 2 mm.

*Leafy stem* sub-erect, up to 8 cm. long, 42 mm. across including the leaves, proliferous from the base and forming clusters.

*Leaves* spirally trifarious, imbricated, spreading, 22 mm. long, 14 mm. broad below middle, 4 mm. thick at middle, the sheathing leaf base 5—5½ mm. long on opposite side to the lamina, ovate, acute, cuspidate, recurved ; *face* concave, concave-triangular towards the tip, minutely scabrous and sandy in the upper ⅔, pink near base, the young leaves light green to light-yellowish green, becoming dark green when old, dull ; *back* convex, triangular towards the tip, minutely scabrous and sandy in the upper ¾, pink at base, dark green above, dull ; *keel* 1, in upper ⅔, gristly near tip, obliquely arranged ; *margins* acute in the lower ⅓, blunt above, scabrous, concolorous.

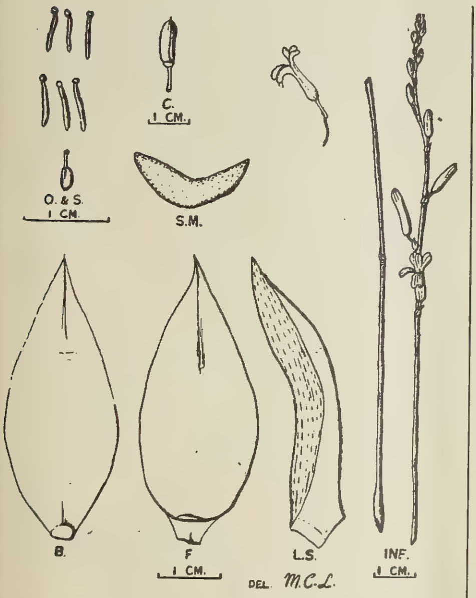

Fig. 1. H. Beanii.

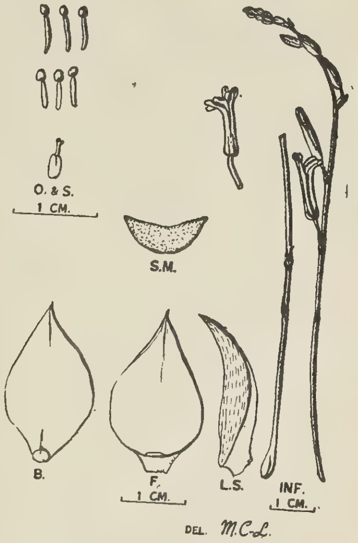

Fig. 2. H. Beanii var. minor.

*Peduncle* simple, terete, ½ mm. diam., 25½ cm. long including the raceme, brown below ; *raceme* 7 cm. long, with about 10 spirally arranged flowers and buds, 1 open at a time ; *pedicels* 7 mm. long, ½ mm. diam., ascending, greenish-brown ; *sterile bracts* 2, 4 mm. long, the lowest 6½ cm. from the base of peduncle ; *fertile bracts* 3½ mm. long, deltoid, acuminate, light brown with a very fine dark brown nerve; *perianth* white, 18 mm. long, the cylindrical-hexagonal base $3\frac{1}{4}$ mm. diam., constricted to $2\frac{3}{4}$ mm. above, not stipitate, oblong, erect-spreading, ± curved; *upper segments* obtuse, channelled, the inner one straight, face colour white at tip, bright green below, with a medium-fine greenish-brown nerve, the 2 outer segments long ± recurved, spreading, face colour white with a broad nerve which is brown near the tip and greenish below; *lower segments* obtuse, the inner one channelled, recurved at an angle of about 90 degrees, face colour white with a medium-fine nerve which is brown at the tip and greenish below, the 2 outer segments replicate, slightly less recurved than the inner, spreading, face colour pure white at tip, bright green below with a medium-fine nerve which is brown at tip and greenish-brown below; *stamens* 5 and 6 mm. long; *ovary* 3 mm. long, $1\frac{1}{4}$ mm. diam., light green; *style* barely 2 mm. long, green, ± bent, ± capitate.

*Habitat:* Cape Province; Humansdorp Dist. (Type, *G. G. Smith* 3678, in East London Museum Herb.; co-types in Nat. Bot. Gdns. Herb., Kirstenbosch and Nat. Herb., Pretoria).

*Distribution:* not further known.

This variety was collected by Miss M. Courtenay-Latimer on the farm Ferndale, near Patentie, in the Humansdorp Dist., in Oct., 1940, growing on a very rocky hill about 2 miles N.W. of the locality for *H. Beanii* Smith. Compared with the species the leaves are much smaller and more loosely arranged, the plant is more proliferous, and the pedicels are longer.

**Haworthia Dekenahii,** G. G. Smith. (Liliaceae-Aloineae.) Sect. Retusae.

*Rosetta* acaulescens, diam. 80 mm.

*Folia* circiter 15, longa 48 mm., lata 20—23 mm., acuta, breviter mucronata; *supra sub parte retusa* plano-concava, laevia; *pars retusa* deltoideo-acuta, longa 28 mm., lata 23 mm., tuberculis parvis orbiculatis prominentibus concoloribus lineisque usque 10 male definitis albido-viridibus ornata; *subtus* convexa, apicem versus ± triquetra, laevia; *carina marginesque* paucis dentibus tubercularibus ornati.

*Pedunculus* simplex, diam. $2\frac{1}{4}$ mm., longitudine 15 cm. una cum racemo longo $10\frac{1}{2}$ cm.; *pedicelli* longi $1\frac{1}{4}$ mm., obscure virides; *ovarium* longum $3\frac{1}{2}$ mm., diam. $1\frac{3}{4}$ mm.; *stylus* longus 1 mm.

*Rosette* acaulescent, 80 mm. diam.

*Leaves* about 15, the young erect, the old spreading, recurved, firm, 48 mm. long, 20—23 mm. broad and 14 mm. thick at base of end-area, acute, not awned, shortly mucronate; *face below end-area* flat-concave, smooth, light green becoming darker above; *end-area* deltoid-acute, 28 mm. long, 23 mm. broad, the old leaves retused at an angle of about 90 degrees, the young less retused, pellucid green, slightly convex, with small round raised concolorous tubercles and many longitudinal white flecks between the lines, the flecks becoming less numerous on old leaves, up to 10 smudgy greenish-white lines of which 1—2 nearly reach the tip, the others progressively shorter with about 3 just showing in the pellucid part between the long lines, the lines parallel-converging but not meeting; *back* convex, ± triangular near tip, smooth, light green in the lower half, dark brownish green above, dull, with about 12 indistinct lines; *keel* 1, near tip, ± obliquely arranged, with a few tubercle-like concolorous teeth above; *margins* acute, with a few tubercle-like concolorous teeth in retused part.

*Peduncle* simple, terete, 2¼ mm. diam., 15 cm. long including the dense raceme, brown towards the lower end; *raceme* up to 10½ cm. long, about 24 spirally arranged flowers and buds, 1(—2) open simultaneously; *pedicels* 1¼ mm. long, 1 by 1¾ mm. elliptic, dark green; *sterile bracts* about 17, 11 mm. long, the lowest 1½ cm. from base of peduncle; *fertile bracts* 8 mm. long, deltoid, acuminate, brownish-white with a broad dark brown nerve; *perianth* brownish-white, the cylindrical-triangular base 4½ mm. across, constricted to 2¾ mm. above, ascending, curved; *upper segments* obtuse, channelled, recurved about 90 degrees, face colour of the 2 outer white with a medium-fine dark brown nerve, replicate near tip, ± spreading, face colour of inner one white above, light green below, with a broad dark green nerve, shorter; *lower segments* obtuse, channelled, very recurved, face colour of the 2 outer white above, green below with a medium-five dark green nerve, replicate near tip and spreading, face colour of inner one white with a medium-fine brown nerve, longer; *stamens* 5 and 6 mm. long; *ovary* 3½ mm. long, 1¾ mm. diam., dull greenish-brown; *style* 1 mm. long, white, bent, ± capitate; *capsule* 13 mm. long, 3¾ mm. diam., brownish-green.

*Habitat:* Cape Province; Riversdale Dist. (Type *G. G. Smith*, 5489, (*Dekenah* 86) in East London Museum Herb.; co-types in Nat. Bot. Gdns. Herb., Kirstenbosch and Nat. Herb., Pretoria.

This attractive species is named for its discoverer, Mr. J. Dekenah of Riversdale, who collected it near Albertinia in the Riversdale Dist., and sent it to the author in Dec., 1942. The plant grows in rock crevices with very little soil. The most striking character and one by which this species is recognised is the longitudinally silvery-white flecked end-area and by the lines made more distinct by the bordering flecks, giving the smudgy appearance, also the very heavy and long bracts which near the apex of the raceme extend beyond the buds. Compared with *H. retusa* (L.) Haw. the leaves have no end-awn, and the backs are dark brownish green.

**Haworthia Reinwardtii,** v. **olivacea** G. G. Smith. (Liliaceae-Aloineae.) Sect. Coarctatae.

*Caulis foliatus*, altus circiter 8 cm., diam. una cum foliis 40 mm.

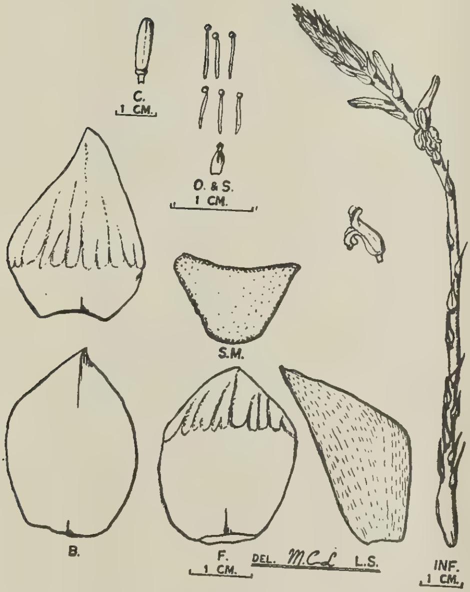

Fig. 3. H. Dekenahii.

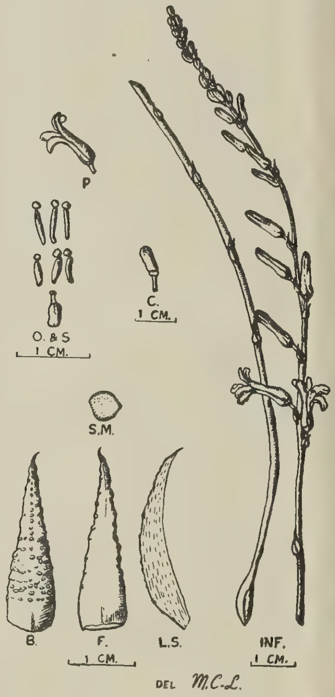

Fig. 4. H. Reinwardtii var. olivacea.

*Folia* crebra, ascendentia, incurvata, longa 33 mm., basi lata 9 mm., lanceolata, acuminata, cuspidata; *supra* plana vel concava, pallide viridia; *subtus* convexa, tuberculis albido-viridibus vel apicem versus plus minusve concoloribus, prominentibus, orbiculatis vel transversaliter oblongatis in lineas 9—11 transversales instructis percursa, olivaceo-viridia, apicem versus pallidiora, nitentia, vetera apicem prope rubida.

*Pedunculus* simplex, diam. 1½ mm.; *racemus* longus 7 cm.; *pedicelli* longi 2½ mm., diam. 1 mm.; *bracteae steriles* 4, longae 4½ mm.; *bracteae fertiles* longae 2 mm.; *perianthium* album, longum 14 mm.

*Leafy stem* sub-erect, about 8 cm. tall, 40 mm. diam. including the leaves, slowly proliferous from the base and forming clusters.

*Leaves* crowded, multifarious, ascending, incurved, firm, 33 mm. long, 9 mm. broad at the base, up to 5 mm. thick above the base, lanceolate, acuminate, cuspidate ; *face* flat to concave, smooth, light green ; *back* rounded, beset with 9—11 transverse rows of raised, round and transversely oblong greenish-white, ± concolorous in young leaves, ½—¾ mm. diam. tubercles, also arranged in 8—10 longitudinal rows, the transverse rows 2¼ mm. apart at the middle of the leaf, olive green, lighter towards the tip, shining, the older leaves becoming reddish near tip.

*Peduncle* simple, terete, fully 1½ mm. diam. near the base, including the raceme 18 cm. long, light brownish-green ; *raceme* 7 cm. long, 12—25 spirally arranged flowers and buds, 2 open simultaneously ; *pedicels* 2½ mm. long, 1 mm. diam., reddish-brown ; *sterile bracts* 4, 4½ mm. long, the lowest 5 cm. from base of peduncle ; *fertile bracts* 2 mm. long, deltoid, acuminate, white with a fine red nerve ; *perianth* white, 14 mm. long, the cylindrical-hexagonal sub-globose base 3½ mm. diam., tapering to the pedicel, only slightly constricted above, oblong, erect, the tube curved ; *upper segments* obtuse, channelled, recurved, face colour of inner one white with a broad light brown nerve, face colour of outer ones pinkish with a broad brown nerve ; *lower segments* narrow obtuse, recurved about 90 degrees, the inner one channelled, the face colour white with a broad brown nerve, the 2 outer segments replicate, spreading, the face colour pink with a broad brown nerve ; *stamens* 4½ and 5 mm. long ; *ovary* 3 mm. long, 1¾ mm. diam., yellowish-green ; *style* 1¾ mm. long, bent, capitate.

*Habitat* : Cape Province ; Kaffir Drift in Peddie District. (Type, *G. G. Smith* 5260, in East London Museum Herbarium ; co-types in Nat. Bot. Gdns. Herb., Kirstenbosch ; Nat. Herb., Pretoria.)

*Distribution :* Not further known.

Though many shades of olive green are noticeable in the varieties of *H. Reinwardtii*, the distinctiveness of the colour is usually detracted from by the whiteness of the tubercles. In *H. Reinwardtii v. olivacea* the tubercles are greenish-white to concolorous and the olive green colour stands out distinctly. It is nearest to *H. Reinwardtii v. fallax* v. P., which plant however often has confluent tubercles on the back of leaves, the leaves are not as spreading and are not as acuminate, and the perianth and fertile bracts are longer.

This distinctive plant was collected by the author in Feb., 1942, near Kaffir Drift in the Peddie Dist. in a rather inaccessible spot.

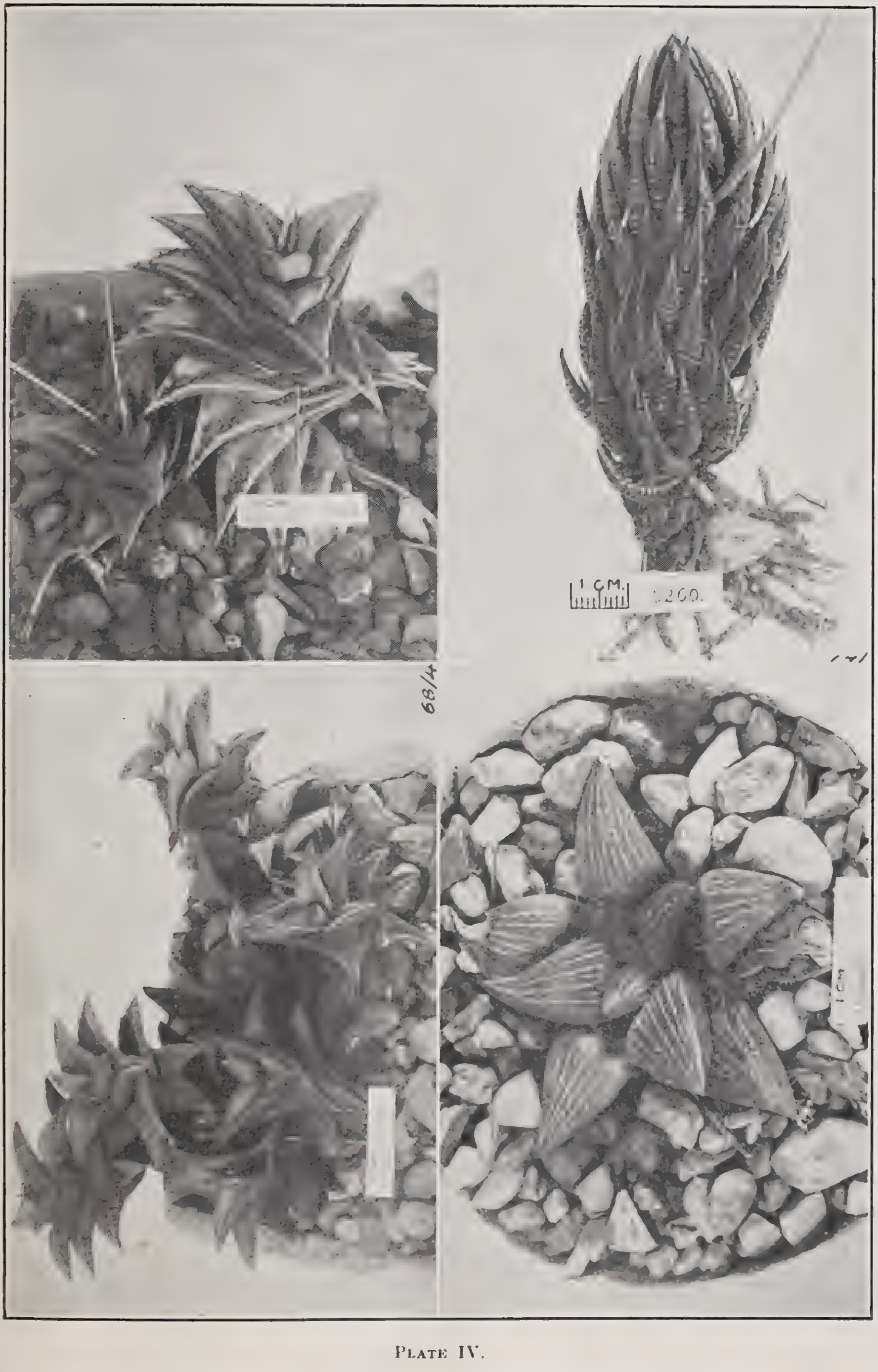

Plate IV.

1. H. Beanii.
2. H. Reinwardtii var. olivacea.
3. H. Beanii var. minor.
4. H. Dekenahii.

# NOTES ON BURCHELL'S *CATALOGUS GEOGRAPHICUS*, MIDDLE PORTION.

By H. G. Fourcade.

In a paper entitled "Sketch Map of Burchell's Trek" (*Journ. S.A. Bot.*, ix, 2, p. 28, April, 1943), Mrs. H. M. McKay gives a list of the localities in which Burchell collected his plants as being "those given in the *Catalogus Geographicus*". Unfortunately, as regards the portion between Gamtoos and Great Brak Rivers, which is the only one that I am competent to deal with, this is not the case, what is given being Mrs. McKay's paraphrases and interpretation of Burchell's text, and these, for want of local knowledge are not seldom wide of the mark. What makes it imperative that the entries in the *C.G.*, if published at all, should be published correctly is that, apart from a few, Burchell did not label or name the specimens on the sheets of his herbarium, merely attaching to each a tag referring, for localities, to the corresponding number in the *C.G.* Plate V is a photograph of one of Burchell's sheets. And, hereunder, is a sample of the *C.G.*, with the addition of determinations, in square brackets, which are not in the original.

At Paardekraal, a.m. 27. Mar. 14.

| | | |
|---|---|---|
| 5168 | Hermannia | [Hermannia salviaefolia L.] |
| 5169 | Erica speciosa, Andr. | [Erica speciosa Andr.] |
| 5170 | Aspalathus | [Aspalathus ciliaris Benth.] |
| 5171 | Piper | [Peperomia retusa A. Dietr.] |
| 5172 | Pelargonium | [Pelargonium peltatum Ait.] |
| 5173 | Rhinanthus | [Melasma scabrum Berg.] |
| 5174 | Indigofera digitata, B. | [Indigofera flabellata Harv.] |
| 5175 | Podalyria | [Podalyria Burchellii DC.] |

. . . . . . . . . . . . . .

I may be permitted to add that I have been to, or close to, every one of Burchell's localities, and many times to most, either when collecting plants or when making maps of the greater part of the region, activities that have extended over many years.

What follows is a transcript of the entries in the *C.G.* Dealing as I am with variations from this text, and lest I be myself accused of departing in any way from the original, I have preferred to retain Burchell's abbreviations as he wrote them, and kept to his punctuation (or want of punctuation). I have added separate comments where necessary for the elucidation of the text, or for refuting Mrs. McKay's version, referred to in the sequel as the *B.T.*, or, once or twice, digressed to record related matters of interest.

## ABSTRACT OF A PORTION OF BURCHELL'S *CATALOGUS GEOGRAPHICUS.*

(1) On the road between Melk River and at Gamtoos River, 18 Febr. 1814 4790–4802.

(2) On the road between Gamtoos River and Inhospitable Station. 21 Febr. 1814 4803–4807.

(3) By the side of rivulet at Inhospitable Station, 22 Febry 1814. 4808–4809.

On the sheet of Burchell 4809, at Kew, is written : "By Leeuwenbosch River, a branch of the Kromme Riv.", which is probably correct, for Leeuwenbosch was an obligatory point, on the road from west to east, mentioned by Thunberg, Lichtenstein, and other early travellers ; and there is, nowhere near, any other rivulet crossing the road.

(4) At Suku, 27 Febr. 1814. 4810–4820.

Suku is not a river, as stated in *B.T.*, but the name of a farm (Zoekoe, still pronounced Suku) through which runs a tributary of the Diep River, not directly of the Kromme. There is a Zoekoe River, but it is elsewhere.

(5) Between Suku and Essenbosch & between Essenbosch and Kromme River to Pietersen's. 2 March 1814. 4821–4837.

Not Essenbosch as given in the *B.T.*, but along a stretch of 30 miles between Suku and Jagersbosch (Pietersen's).

(6) In a walk to a woody kloof on the northern side of the Kromme River near to Wagenbooms Station. 7. March 1814. 4838–4884.

Wagenbooms Station was near Hendriks Kraal, not near Company's Drift, as wrongly stated in the *B.T.* Company's Drift lies 2·5 miles further west. There is no wooded, or considerable, kloof, on the northern side of Kromme River, anywhere near Company's Drift, but there is one, facing Hendrik's Kraal, that is both wooded and deep.

(7) At Wagenboom Station on the Kromme River, 9. March 1814. 4885.

(8) On the road between Wagenboom Station & — River in Lange Kloof 10 March 1814. 4886–4895.

Not at "Wagenboom River Station," as in *B.T.*, but along a stretch of 14 miles between two points. The next entry indicates that the unnamed river was the Wagenbooms River at Joubertina.

(9) On the rocky side of the mo$^{n}$ on the w$^{n}$ bank of the Wagenboom River on the north side of Lange Kloof, 11 Mar. 1814 4896–4937.

The Wagenbooms River, at the western end of Joubertina, leaves Long Kloof, between steep rocky slopes, to join the Kouga.

(10) On the road between Wagn. River and Anagallis Station near Rademeyer's 12 Mar. 14. 4938–4944

Again, not Anagallis Station but a stretch of 14 miles up to it. Rademeyer's is at Lauterwater where their clan still farms.

(11) At Anagallis station in Lange Kloof a.m 13 Mar. 14 4945–4950.

(12) On the road between Anagallis Station and Ignace Ferreira's in Lange Kloof p.m. 13. Mar. 14. 4951–4966.

Not Ignace Ferreira's, as in *B.T.*, but a stretch of 12 miles between Lauterwater and Misgund.

(13) On the road between Ignace Ferreira's and Groote River in Lange Kloof a.m. 10 Mar. 14. 4967–4976.

Groote Rivier, a principal branch of the Kouga river, flows W. of Haarlem, and has retained its early name.

(14) At the Groote River in the Lange Kloof mostly on a rocky hill below the mo$^{n}$ near station p.m. 14. Mar. 14. 4977–5028.

The rocky hill which arises abruptly from the railway line South of Haarlem.

(15) On road between Groot River and Avontuur, Matthy Zondag's in Lange Kloof, 17 Mar. 14. 5029–5037.

(16) 18 Mar. 14 5038–5066.

No indication is given of the locality of this entry but, evidently, it is the road between Avontuur and the Keurbooms river in Long Kloof, a stretch of 13 miles. The *B.T.* has here an imaginary entry, not a word of which appears in the *C.G.*:

> "Backhuysen [near Mikes] at Groote R. in Lange Kloof [Groote River is Keurbooms River]."

besides which, Backhuysen's (of entry 17) is not near Mikes but 3 miles nearer Avontuur. Nor is it at Groote R. in Lange Kloof, nor is Groote R. Keurbooms River.

(17) On the rocky kloof about the source of the Keurbooms River at Baakhuyzen's in the Lange Kloof. 20. Mar. 14. 5067–5082.

The only old house about the source of the Keurbooms River is the one at Speelman's Kraal. The name is not that of the locality, which is Keurbooms River, but was given to the Post Office there from that of a place further north, to avoid confusion with the P.O. Keurbooms River at Knysna. The present Barkhuysens are rather hazy about the places their forbears occupied in Burchell's days. Fortunately there is the definite testimony of early travellers to show what some of these were. Latrobe relates that the place he rested at, from March 26 to 28, 1816, and passed again, on his way back, on April 29, was "Jacomima Barkhuis' farm on the Keirboom's Revier", that she was an "old lady," and that, on March 27, "some of us took a walk into the rocky glen out of which the Keirboom's-Revier flows," exactly as Burchell had done two years before. Bowie, some three years later, refers to her as a widow. Her husband may have been still alive when Burchell was there. A son of the old lady farmed at Klip River, a place passed or visited in turn by Burchell, Latrobe, Bowie, and, later by Drège.

Speelman's Kraal was one of the stopping places on the road to the eastern border. Lord Charles Somerset, in his ride to the frontier, proceeded in stages from Schoenberg to Speelman's Kraal (20 miles) and from Speelman's Kraal to Niewe Plaats (Somerset's Gift), 39 miles. At each of the first two places he planted a tree, and these are said to be still growing. At Niewe Plaats he put up at Ferreira's, descendants of whom still own the place and preserve as an heirloom a brooch presented by Lord Charles. It is possible that he broke, at Avontuur, the long second stage, but of this there is no record, nor did Mr. M. P. Zondagh, of Avontuur, know of any tradition. The only paper relating to early travellers that Mrs. Zondagh had to show was a letter from Latrobe, thanking the Zondagh of the day, very warmly, for the kindness and hospitality he had received at Avontuur, in contrast with a disagreeable experience elsewhere. Burchell had a similar experience at Inhospitable Station, as mentioned in the *B.T.*, p. 54. Such cases were no doubt rare exceptions to the general practice, of ready hospitality to wayfarers, which prevailed, in early days, among Boers of the better class.

(18) In the moun$^{n}$ close to Baakhuyzen's house and along the rivulet on Keurbooms River in Lange Kloof, 22 Mar. 14. 5083–5098/2.

The rivulet was, probably, the one opposite Speelmans Kraal and the mountain the western end of the range of which Krantzberg (4027 ft.) is the highest point.

(19) Along the Nua'kamma, a ravine rivulet on the S.W. side of the Keurboom River 5 p.m. 23. Mar. 14. 5099–5110.

The Nuakamma, still known by the name, is crossed, 10 m. from Speelmans Kraal and 7.3 m. from De Vlugt, very close to its junction with the Keurbooms River. It is an inconsiderable stream, and there is a small native kraal (April's Kraal) above the road.

The *B.T.* has "[near Forest Reserve]" from which it is actually separated by the Outeniqua Range and the Klein Long Kloof mountains.

(20) On bank of Rivulet at Romans Kraal near the Keureboom River. 1.p.m. 24 Mar. 14 5111–5122.

(21) Along the Keureboom River on the road between Nua'kamma river and Roman Kraal a.m. 24. Mar. 14. 5123–5133.

Note that (21) precedes (20), as indicated by the entries 1 p.m. and a.m. From the Nuakamma, Burchell went down, for 3 miles, along the Keurbooms River until he crossed Pieters River immediately beyond which he pro-

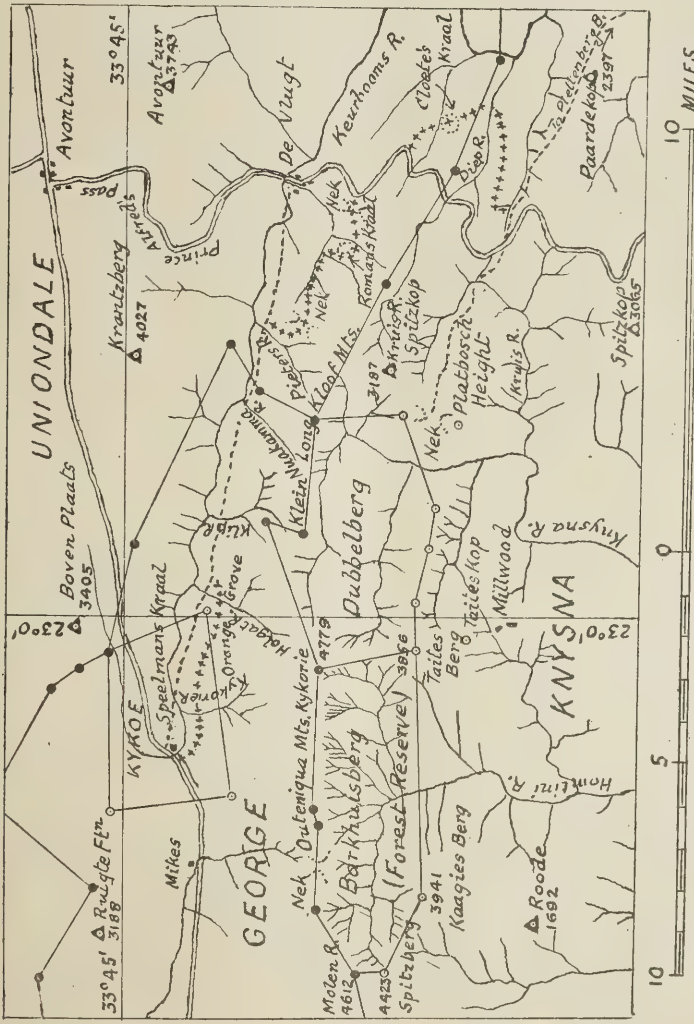

Fig. 1. Sketch-map of Upper Keurbooms and adjacent country on the south. Scale: 1/250,000. The filled circles are points of the boundaries of Divisions, the lines of dashes, divisional roads, and the lines of crosses represent Burchell's track where it departed substantially from existing main or divisional roads.

ceeded to ascend by the old track to the nek overlooking the W.-E. valley, 3 m. long, of Smalldeel and Romans Kraal. The track he then followed runs along the Jigukamma stream, out of which it climbs at the back of Romans Kraal. From Romans Kraal the track curves to the south and finally emerges on a nek (1900 ft.) about 100 yds. W. of the present main road, at a point 2·5 m. from De Vlugt. From this nek the photograph reproduced on Plate VI was taken.

The *B.T.* has for (21) : " Nuakamma River—Romans Kraal [near Dubbelberg] " the essential informative words " along the Keureboom River ", which are incompatible with the " near Dubbelberg " interpretation, being suppressed.

Referring to its map (9B, p. 77) the route imagined in *B.T.* starts from Mikes, crosses the Outeniquas at the nek overlooking the " Forest Reserve ", proceeds somehow to the Knysna River below its confluence with the Kruis River and then continues south of the Kruis River to the main road from Avontuur at its junction with the road to Plettenberg Bay.

Mikes is a stopping place of the Railway road motor service, named after Mr. Michael Barkhuysen sen. whose home stands a few hundred yards to the north. It is 3 miles from the Keurbooms River and there is no kind of mountain near, so that it cannot possibly be at the Barkhuysen's mentioned in (17) above. Besides Mr. Barkhuysen informs me that his house was built 70 or 80 years ago and therefore was not in existence in Burchell's days. Nor was there any previous one on the site.

From Mikes the foot of the nek above the " Forest Reserve " is easily accessible, but there is no kind of wagon track to the top ; only a footpath exists. The " Forest Reserve " of the map, known locally as Barkhuisberg contains the headwaters of the Homtini River, with only a few small patches of forest, all inaccessible. These were, formerly, elephant and buffalo paths, along which a horse is said to have sometimes been taken from Long Kloof to the Millwood Gold Fields, but no possible wagon track. The basin is scored fanwise by very deep ravines, almost like saw cuts, which cannot be avoided. I have, myself, been on both Barkhuisberg and Dubbelberg, and Mr. F. S. Laughton, District Forest Officer, Knysna, went to reconnoitre the first when it was decided to reserve catchment areas in the mountains ; as did also a Forester to make the sketch-map which is incorporated, on a much reduced scale, in Fig. 1, but, with the exception of herds looking for strayed cattle, and, may be, some hunters, very few others have ever been there, certainly not Burchell and his waggon. In the Barkhuisberg, the altitudes range from 4779 ft. at Kykorie to some 500 ft. or less in the bed of the Homtini, where the river crosses the Southern boundary, which may give some idea of the rugged nature of the ground. In 1891, while acting as Inspector of Mines, Millwood, I found that much prospecting had been done in the surrounding country, but that Barkhuisberg had, so far, been left severely alone by all prospectors.

Mr. Laughton who has seen a draft of these notes endorses my observations on the place, save that he doubts that a horse could ever have been taken across Barkhuisberg.

From Barkhuisberg the *B.T.* route, ignoring one or two insurmountable obstacles on the way, proceeds vaguely to a point of the Knysna River below its junction with the Kruis River. There is no possible crossing here. On

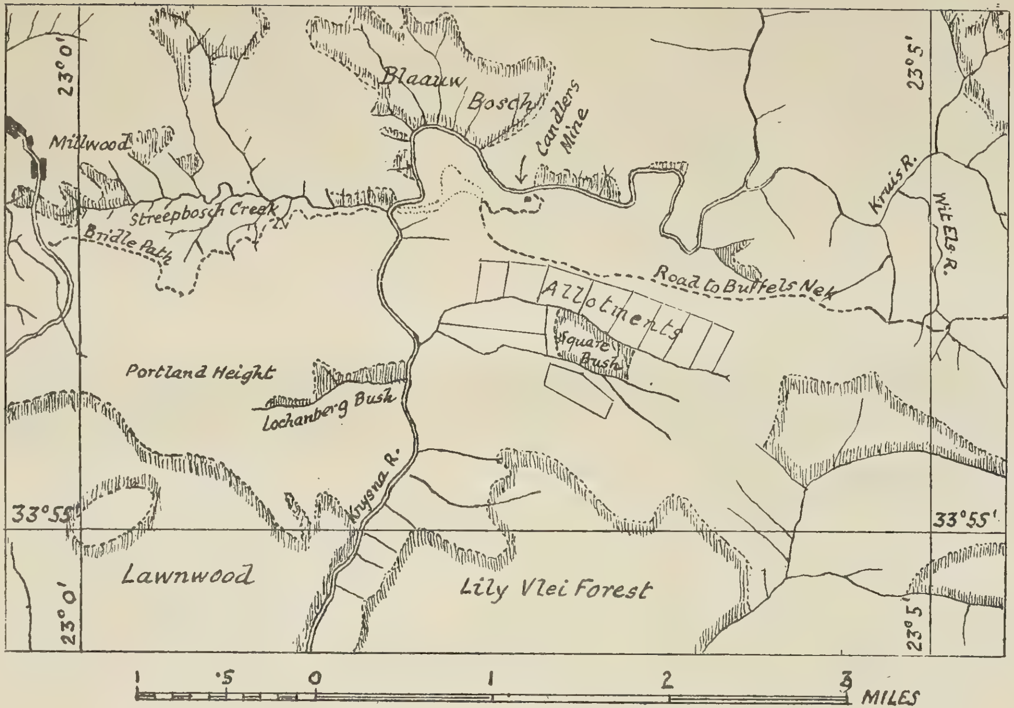

Fig. 2. Map of middle portion of Knysna River. Scale: 400 Cape Roods to 1 in. = 1/59,500.

the west there was a footpath from Millwood to the river, which I improved by setting out the bridle path shown in Fig. 2. On the east, there is a road, down to Candler's mine in the river, which was constructed, by the mining company, for taking down machinery, but it does not go through. This road is a prolongation of the road, from Buffels Nek, on the Main Forest road, to the Square Bush allotments. No road much nearer the Kruis River is practicable, because of the deep gorges of the Wit Els River and other tributaries.

The *B.T.* route has now been shown to be quite impracticable, both at Barkhuisberg and at the Knysna River, and, had he followed it, Burchell would necessarily have by-passed the Nuakamma, Romans Kraal, and Cloete's Kraal.

The *B.T.*, p. 56, has : " In Burchell's map the name Keurbooms R. is, in several cases, given to what is now named the Kruis River. It is not until he reaches Paardekop that his portrayal of rivers becomes more definite." This remark was a rather rash one to make about a most careful and painstaking observer, and amounts to admitting that no support is given by Burchell's own map to the *B.T.* interpretation of his route.

The *B.T.* proceeds : " He shows Schuurberg which may be interpreted as Kruis River Spitskop." This cannot be ; for, from Burchell's actual route, K.R.S., on which I have been, as it was a principal station of my surveys, is hidden by the intervening range of the Klein Long Kloof. More probably, it is the peak of that range on the north spur of which lies the nek known as Schuurbergs Nek at the western entrance of the Romans Kraal Valley. The exit nek on the east is known as Romans Kraals Nek. See Plate VI.

(22) At Mantis Station & on the road thence to Cloete's Kraal. 25 Mar. 14.
5134–5144.

(23) In the deep woody ravine by the streamlet at Cloete's Kraal. 8. a.m.
26 Mar. 14. 5145–5150.

Cloete's Kraal is situated on the farm Uitvlugt, in the Uniondale Division. The stream which flows through it is crossed at 5 m. from De Vlugt and 2 m. before the Knysna boundary is reached at Diep River. It is shown on the Uniondale Divisional map and is mentioned by Lichtenstein who explains that " the place is called Cloetes-Kraal from a Hottentot family of that name who once resided there." The name has now been corrupted to " Klutskraal ". The forest along the stream has been severely damaged by fire, and the old kraal below the road, is no longer, probably through disappearance of fine trees, the beauty spot which made Lichtenstein call a pool in its kloof " Diana's bath ".

Cloete's Kraal is about 6 m. by road from Romans Kraal. Burchell arrived there in the afternoon of March 25 and left again the following afternoon. Mantis Station being between (21) and (22) would be somewhere near the place called Assegaibosch. From Romans Kraal Nek, near the Vlugt road, mentioned in (21), Burchell may have travelled the next 1·5 miles to the ridge north of Cloete's Kraal river by following either of two old tracks, the one above, and the other below, the present main road, and then kept on along the ridge down to Cloete's Kraal.

(24) On the road between Cloete's Kraal and Paardekraal p.m. 26. Mar. 14. 5151–5167.

Burchell continued down the Cloete's Kraal ridge, south of the river, to the only crossing of the Diep River that was possible before the new main road was constructed, there being a succession of precipitous cliffs higher up, and reached Paardekraal, on the farm Roodemuur, in the division of Knysna.

(25) At Paardekraal, a.m. 27.Mar. 14. 5168–5182.

(26) On Paardeberg. p.m. 27 Mar. 14. 5183–5197.

From Station (25) Burchell proceeded W. up the valley of the Diep River, which is practicable on the S. side, crossed to Klein River, over the intervening ridge, at a point not far from the present main road, and then kept on along the old track from Kruis River Nek to Plettenberg Bay which the present road at first closely follows. Paardekop (=Paardeberg) is one of the principal stations of my surveys. The original old track—there are one or two others—passed over its summit.

(27) In forest close to station by rivulet at Kaatjes Kraal. 30 Mar. 14. 5198–5213.

Katjes Kraal, on the farm Sarel, is off the present road to Plettenberg Bay, but on the old road to Stofpad.

(28) In the forest near the station at Kaatjes Kraal, 31 Mar. 14. 5214–5225.

(29) On the edge of forest. at the station Kaatjes Kraal, 1 April 1814 5226–5251.

(30) In a walk to Hartebeest Vlakte and at Kaatjes Kraal. 3 Ap. 14. 5252–5268.

Hartebeest Vlakte are the plains of Uplands which extend eastwards from Katjes Kraal to the Hartebeest River. "Wynand's Kraal", in *B.T.*, for Hartebeest Vlakte is incorrect.

(31) At Kaatjes Kraal, in forest. 5 Apr. 1814. 5269–5273.

(32) 8 Ap. 14. 5274–5279.

Burchell remained a week at Katjes Kraal, collecting, the while, specimens of forest trees and shrubs, of which he was given the vernacular names by Van der Walt sen. and a Hottentot, Gerson. He obtained: 5202, *Buddleia salvifolia* (Saliehout); 5208, *Cunonia capensis* (Red Els); 5209, 5215, *Trichocladus crinitus* (Onderbos); 5211, 5242, *Ilex mitis* (Wittehout); 5212, *Curtisia faginea* (Assegai); 5219, *Cassine velutina*; 5222, 5264, *Apodytes dimidiata* (White Pear); 5223, *Podocarpus latifolius* (Upright Yellowwood); 5225, 5227, 5272, *Olea laurifolia* (Ironwood); 5220, 5273, *Plectronia Mundiana* (Klip Els); 5235, *Pterocelastrus tricuspidatus* (Kersehout); 5236, *Ocotea bullata* (Stinkwood); 5237, 5271, *Cassine crocea* (Saffraan); 5240, 5270, *Lachnopylis floribunda* (Vlier); 5245, 5254, *Podocarpus falcatus* (Outeniqua Yellowwood); 5246, *Plectronia ventosa* (Schaapdrolletjes); 5253, *Platylophus trifoliatus* (Wit Els), 17 species in all, besides a few numbers missing or undetermined.

(33) Between K.K. and Van der Wat's p.m. [9] Apr. 14. 5280–5281.

(Hendrik) Van der Watt's was on Stofpad, close to the Bitou River. The old road from Stofpad to Katjies Kraal is still travelled on horseback.

(34) In a forest at Van der Wat's 10. Ap. 14. 5282–5295.

The forest is still extant, though somewhat reduced by fires. It lies not " W. of Kafferkop ", but, on the contrary 4 m. to the east.

(35) On road be$^{n}$ V. Wat's & Deep River Plettenberg Bay. 12 Ap. 14. 5296–5305.

*I.e.* between Stofpad and Plettenberg Bay, not at " Deep River [Bitou River—W. of Wittedrift]." Besides " Diep River " is not Bitou River but a tributary of the same. Bitou River had already been crossed by Burchell at or below Stofpad. The old road, after passing the Diep River, climbed out of the valley to head straight for Plettenberg Bay. The present road continues to the Bitou and along its eastern bank to join the main coast road at the Bitou bridge. It is more circuitous but quite level.

(36) In Plettenberg Bay near Landing Place on Sandhills, 10 Ap. 14. 5306–5323.

The landing place at Plettenberg Bay was the small beach immediately below the village of Formosa. The ruins of the timber store erected by the Netherlands East India Company are preserved as a National Monument.

(37) In Plettenberg Bay, on the " Baak " hill and on hills about the spot 17 Ap. 1814. 5324–5345.

The hills on the slopes of which Formosa stands.

(38) Close to the Landing Place in P. Bay 21 Ap. 14. 5346–5347.
(39) On road betw. P. Bay & Melkhout Kraal, 22 Ap. 14. 5348–5379.
(40) At Melkhout Kraal in a walk to the mouth of Nysna from house. 29. Ap. 14 5380–5385.

Melkhout Kraal, the estate of G. Rex, " the most Beautiful estate in the whole Colony " (Barrow).

(41) 1 May 14. 5386–5390.
(42) In forest close to Melkhout Kraal by the quarry 6. May. 14. 5391–5431.
(43) In same part of forest as on 6th, but deeper, along the kloof 10 May. 14. 5432–5440.
(44) At entrance to same part as on 6th 11. May. 14. 5441–5446.
(45) Close by house in forest, Melkhout Kraal 31. May 14. 5447.
(46) 7th June 1814 5448.
(47) On the hills near to end south$^{ds}$ of Melkhout Kraal, 8 June 14. 5449–5465.
(48) Along road by small wood just below garden at M.K. 20 June 14. 5466–5483.

(49) From hills near house at M.K. brought by Speelman. 23 June 14
5484–5487.

(50) In a walk from M.K. towards the cornland (*i.e.* the shore) 26 June 14.
5488–5493.

(51) About M.K. 29 June 14. 5494–5507.

(52) In an excursion from M.K. to the mouth of the Nysna. 3 July 14.
5508–5518.

(53) 11 July 14 5519–5520.

The entry against 5520 is " brought by H. from the Hout Bosch " Boschjesmans thee " ", and it refers to 5520 only, not to 5519 and 5520, as incorrectly stated in *B.T.* The specimen was *Catha edulis* Forsk., a species that has never been found again in the region.

(54) At the Nysna's drift (on left bank) 5 p.m. 12 July 14.
5521–5522.

(55) At Zand Kraal, on the w$^{n}$ side of the Nysna drift near the [here a word illegible: *fort...d?*] 13 July 14. 5523–5538.

Zand Kraal is on the farm Westford.

(56) In forest at our waggon sta$^{n}$ at Zand Kraal—at forest by " Nysna's hoek " 20 July 14. 5539–5542

There are practically no forests left on Westford. They were obliterated by the great fire of 1869.

It is probable that it was on returning to Melkhout Kraal, sometime between July 20 and 25, that " Burchell had the misfortune to have his waggon overturned " in the Salt River near Knysna, as related by Bowie in his diary.

(57) At Melkhout Kraal 25 July 14 5543–5547.

(58) 31 July 14. 5548.

Burchell, except for a week, or at most two, on an excursion to Zand Kraal (Westford) remained for three months on George Rex's farm, Melkhout Kraal, and as he collected on only 18 days of the period, and only one or two numbers on some of the days, he must have been thrown much in the company of Rex whose generous hospitality has remained a tradition. The remark in the *B.T.* that " there is no direct evidence that he was a guest in George Rex's home " is apt to be misleading because, although there may be no evidence known that he was ever a guest of Rex's, it remains very improbable that he was not, any of the time. Bowie, who came to the region in 1818, four years after Burchell, and made Plettenberg Bay his headquarters, was, for weeks and months at a time, a guest of Rex's, and, in January 1820, accompanied him on a trip to Cape Town, whence they returned together in March of that year. Lord Charles Somerset was another guest at Melkhout Kraal and brought with him the famous Dr. Barry. Latrobe who in March 1816, remained two or three days at Melkhout Kraal, writes: " We soon perceived, that it was our worthy host's intention to detain us here as long as he could ", and, again: " We had now much difficulty to prevail upon our hospitable host to let us depart in the morning."

(59) From the Hout hoek near M.K. 2 Aug. 14. 5549–5550.

Not "brought from "Houtbosch" ", as in *B.T.*

(60) On road betw. M.K. & at Nysna's drift 5. Aug. 14. 5551–5554.

(61) On road between Nysna's drift & Goukamma station, 6 Aug. 14. 5555–5567.

Not "Goukamma Station" as in *B.T.*

(62) Near our waggon Stn. between Goukamma & Juffrouw Vosloo's or at the Gou' station 7 Aug. 14. 5568–5604/1.

(63) On road betw. Gou' station and station at the end of Groene Valley. 8 Aug. 14. 5605–5623.

Not at "Groene Valley", as in *B.T.*

(64) Near wagon station at the w. of Groene Valley, 9. Aug. 14. 5624–5646.

(65) On sandhills S. of wagon station at W. end of G. valley. a.m. 12 Aug. 14. 5647–5667.

(66) Between G. Valley & our station at Zwarte Valley p.m. 12 Aug. 14. 5668–5684.

The old road, from Groen Vlei to Rondevlei, followed by Burchell, crossed the mouth of the Zwart River which is most times closed. The route imagined in *B.T.*, round the north side of Zwart Vlei, is an impossible one because the only road that can cross the Zwart River leads north to Hooge Kraal, and is, even now that the old drift has been raised by a causeway, impassable for months at a time when the mouth is closed. If further proof were needed, it is supplied by the plants collected by Burchell which include: 5668, *Agropyrum distichum*, 5669, *Senecio elegans*, and 5671, *Cnidium suffruticosum*, species characteristic of littoral sand-dunes.* The station at Zwart Vlei was therefore on the S. side of the vlei, not "E. end of Swart Vlei". On a recent re-visit (Febr. 1944) I made out that that the only possible site of Burchell's station was the present sea-side camping ground, just north-east of hill 315 on the map of Fig. 3.

(67) Betw$^{n}$ Zwarte Valley and our station near Lange Valley. 13 Aug. 14. 5685–5696.

The *B.T.* emends this as "Station near Lange Vallei [N.W. end of Swart Vlei]," overlooking the fact that Rondevlei lies between Zwart Vlei and Lange Vlei.

(68) Near same place, 14 Aug 14. 5697–5700.

Here *B.T.* anticipates the next entry with: "near the station (at La Harpe's, near Lange Vlei)".

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* Confirmation of the use, in early days, of a road across the mouth of Zwart River is afforded by Backhouse (*Narrative of a Visit*, &c.): "We had to cross the mouth of the Zwarte Rivier, on the beach, where it is choked with sand, and to make a circuit to cross the Goukamma." The date is 10 Nov., 1838.

H.G.F, May 1944.

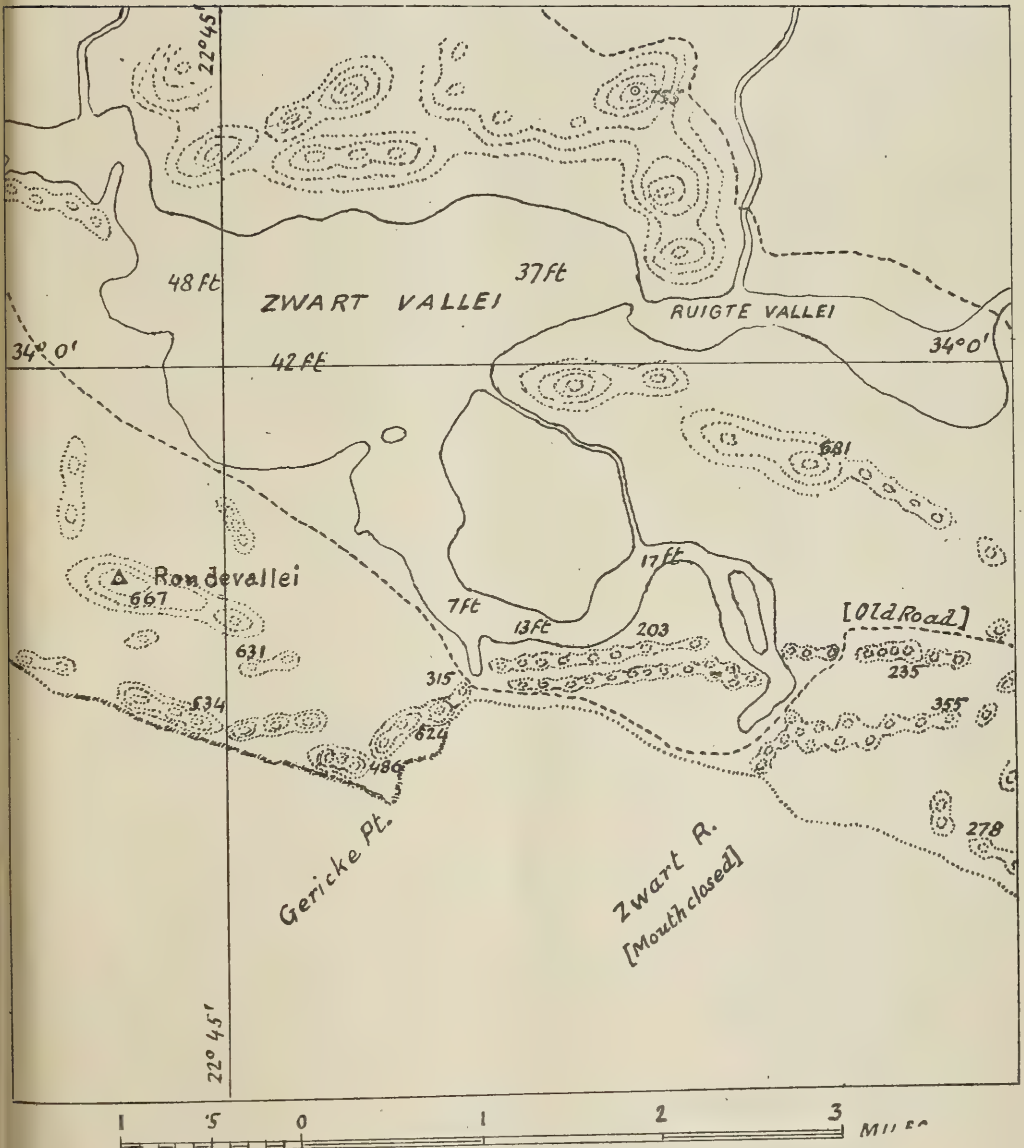

Fig. 3. Extract from MSS. map of Admiralty coast surveys, Malagat River to Plettenberg Bay, executed about 1865. The scale is altered to 400 Cape roods = 1 inch, to conform with that of my general plans. The old roads shown were sketched in by me some years earlier than 1904, when I left the service. Inscriptions in square brackets are also additions, but "mouth closed" appears on the Admiralty Chart: Africa, South Coast, sheet 3, published in 1867, of which the coast surveys formed the basis. The coast line, and its immediate vicinity, I found, wherever checked in the course of my own surveys, to be very accurate. The map shows that, about 1865, the mouth was closed by a land bridge some ¼ mile broad.

(69) On rocky hill by spring near La Harpe's house near Lange Valley. a.m. 18 Aug. 14. 5701–5711.

I found no La Harpe remembered at Lang Vlei. There is no such name in the Voters' List, and neither the George Magistrate, nor the Secretary of the Divisional Council had knowledge of any, past or present. The only La Harpes traced at George were two girls in the Orphanage, but they had come from Komgha. However, at Lang Vlei, I was told that there used to be a spring under a " klip kop " in about the right locality, but the place is now under cultivation and the spring apparently dried up.

(70) In plain about 4½ miles from La Harpe's on road betw. Lange Valley and Trakadato'w. p.m. 18 Aug. 14. 5711/2.

From La Harpe's, Burchell continued due west, for about 2½ miles, until he reached the road from Klein Krans to George, by which he ascended, out of the Lake country, to the Olifants Hoek plateau, and reached the Touw Station 7 m. from his starting point. At 4½ m. from La Harpe's he would be on the open flats in the middle of Olifants Hoek. The whole road was mapped in my survey of Olifants Hoek.

The *B.T.* has here " Trakadakow station [near Ronee Valley P.O.] " and the further note " Burchell here turned north and joined what is now the main road from Woodville to George ". There is no " Ronee Valley ". Presumably Rondevlei is meant, but this is 5·5 miles from the Touw station, not near it. And Burchell turned north at Klein Krans, on his way, not at the Touw station which was his destination.

(71) By rivulet at Trakadato'w station, on the edge of the forest, and in forest. 20. Aug. 11. [14] 5712–5729/2.

The old road crossed the Touw close to the present bridge. The Station was probably at the old outspan on the east side of the river, there being, near the road, much less forest on the other side. A picture of the pass is given in Latrobe's " *Travels* ". Not good.

(72) Near the spot where our wagon stood at Tra-station, not in forest 21. Aug. 14. 5730–5754.

(73) In forest, Trakadakow's station 22 Aug. 14. 5755–5764.

(74) On road betw$^{n}$ T. Station & our station on the W. side of Kaymans Gat 24. Aug. 14. 5765–5784.

The *B.T.* has here, incorrectly, " Western side of Kaaiman's Gat ", and adds, still more incorrectly, [Woodville] which, by the old road, is 11·5 miles away.

(75) Main Station on W. side of Kayman's Gat. 26 Aug. 14. 5785–5806.

(76) In the wood by the side of road ascending the W$^{n}$ bank of Kaiman's Gat. 28 Aug. 14. 5807–5809.

The old road which ascended the main ridge of Pampoen Kraal, between the Kaaiman and Klein Zwart rivers.

(77) Restiones varii pro locis vide—Plantas integras in Herbar. 5810–5813.

The *B.T.* lumps these with the preceding entry.

(78) By side of rivulet in forest at sylvan station near village of George in Auteniqualand. 30 Aug 14 5814–5815.

(79) In forest at sylvan station close to the spot where wagons stood p.m. 2 Sept. 14 5816–5834.

Note that Burchell wrote " wagons " in the plural, but at (72) in the singular. Also that Bowie (see 55) speaks of his wagon, not of one of his wagons. Burchell may have parted earlier with the light wagon he procured at Tulbagh, with which he several times had trouble, as the wood of it had not been properly seasoned,* and replaced it by another, in George.

(80) 5 Sept. 14. 5835–5843.

(81) 8 Sept. 14 5844–5891

(82) In Post-berg near village of George in Auteniqualand. In ascent up the eastern ridge. 11 Sept. 14. 5892–5922.

Postberg is the old name of Cradocksberg.

(83) In the descent down western ridge of above, 12 Sept 1814. 5923–5992.

(84) At sylvan station, 15 Sept. 14 5993–6008.

(85) On Lower part of Postberg on the lower part of E^n^ ridge where we had before ascended on the 4 Sept—20 Sept 14. 6009–6032.

(86) In a walk from Sylvan S^tn^ to the Drostdy at village of George [23 Sept. 1814] 6033–6035.

(87) At sylvan station, 25 Sept 14 6036–6042.

(88) In forest at S. Station, 29 Sept 14. 6043–6054.

(89) On plain round S. station. 29 Sept. 14. 6055–6067.

(90) At Sylvan Station near George. 2nd Oct 1814. 6068–6069.

(91) In forest near S. station 4 Oct. 14. 6070–6084/2

(92) On road from Sylvan station and No'wsakamma River. 6 Oct. 14. 6085–6100.

*i.e.* between George and Witte Els River, not at Witte Els River, as in *B.T.*

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* H. M. McKay. " A Scientist's Wagon." S.A. Journ. of Sc. 32, 680 (1935).

(93) At the No'wsakamma River (or Witte Elze River) at the Wolvedrift (or Hyenaford) 7 Oct. 14. 6101–6123.

The river is the Malgaten River, 8·9 m. from George, on the old road to Great Brak River, and on the farm Noetzekamma. It is also called Wit Els River, and often confused with the Malagas River next to George.

(94) On road from No'w$^{a}$ river to the "Groote Brakke Rivier." a.m. 8 Oct. 14. 6124–6148.

The *B.T.* here includes, incorrectly, these numbers in the preceding entry which is given as "At the Drift—Witte Els R."

The foregoing list covers, after allowing for omissions and duplications, 1,356 numbers, of which 1,215 are those of Phanerogams and 141 those of Cryptogams. Of the first, about 926 have been identified, and they comprise 609 species. If the same proportion of species to numbers holds for the remaining 430 numbers, missed, or missing, or of which no definite specific identification has been found, Burchell must have collected altogether some 890 species of flowering plants in the region.

## REMARKS ON BURCHELL'S MAP.

Burchell's map appears to be missing from most of the copies of the *Travels*—those in South Africa at any rate. According to Mrs. H. M. McKay,* "One explanation offered for the absence of the appendices is that the *Travels* was in great demand during the South African war by the army intelligence department, and naturally the map and the text about it were of special value!" I was unable to trace any copy of the *Travels* that included the map until I had written a draft of these notes and drawn the maps which are attached. At last (on Febr. 28, this year), when showing the notes to Dr. A. V. Duthie at her home at Belvidere, Knysna, in the hope that she might have gathered some further information about Burchell's stay at Knysna, she mentioned that she had a copy of Burchell's book which possibly contained the map, and this proved to be the case. The map which, by the way, was found detached was then very kindly loaned by Dr. Duthie, and a portion of it is reproduced in Plate VII.† The accuracy of Burchell's map having been impugned, it is perhaps just as well that I established his route without recourse to his map, and that I should refrain from adding now, to the text of the notes, references to the map. The map is perfectly correct along the whole route that I traced, and speaks for itself. Amongst other things, it confirms that "Inhospitable Station" was on Leeuwenbosch R., that "Baakhuyzen's" of (17) was at Speelmans Kraal, that Burchell proceeded thence down along the Keurbooms R., as far as Pieters R. (=Pietersens R.), not to Mikes and across Barkhuisberg, and that he crossed Zwart R. below Zwart Vlei, not above. It is incomprehensible how Mrs. McKay, whose previous papers on Burchell are excellent, should, with the map before her, have gone astray so widely and repeatedly when she had not a vestige of a reason for doubting its accuracy.

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* H. M. McKay. *William John Burchell.* Botanist. Journ. of S.A. Bot., 7, 184 (Oct., 1941).

† Out of four more copies examined since in Cape Town, only one lacked the map, so that the condition may not be as general as it was imagined to be. H.G.F. May, 1944.

Witte Els Bosch, C.P.,
April, 1944.

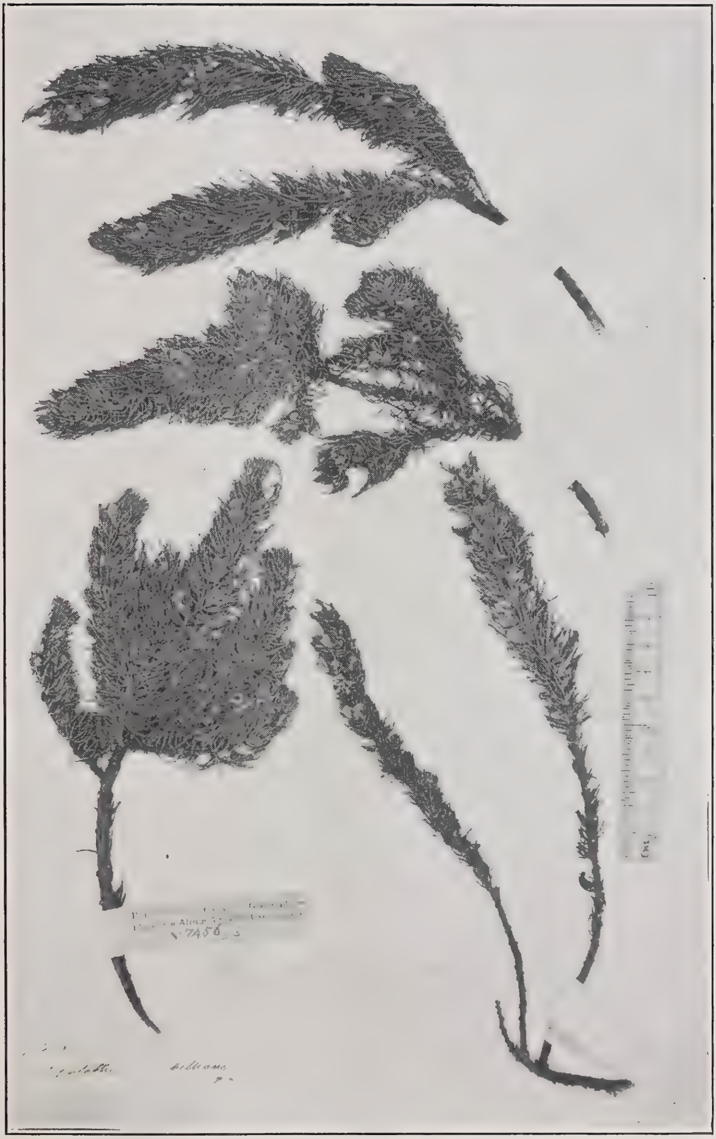

Plate V. Specimen of a sheet from Burchell's Herbarium.

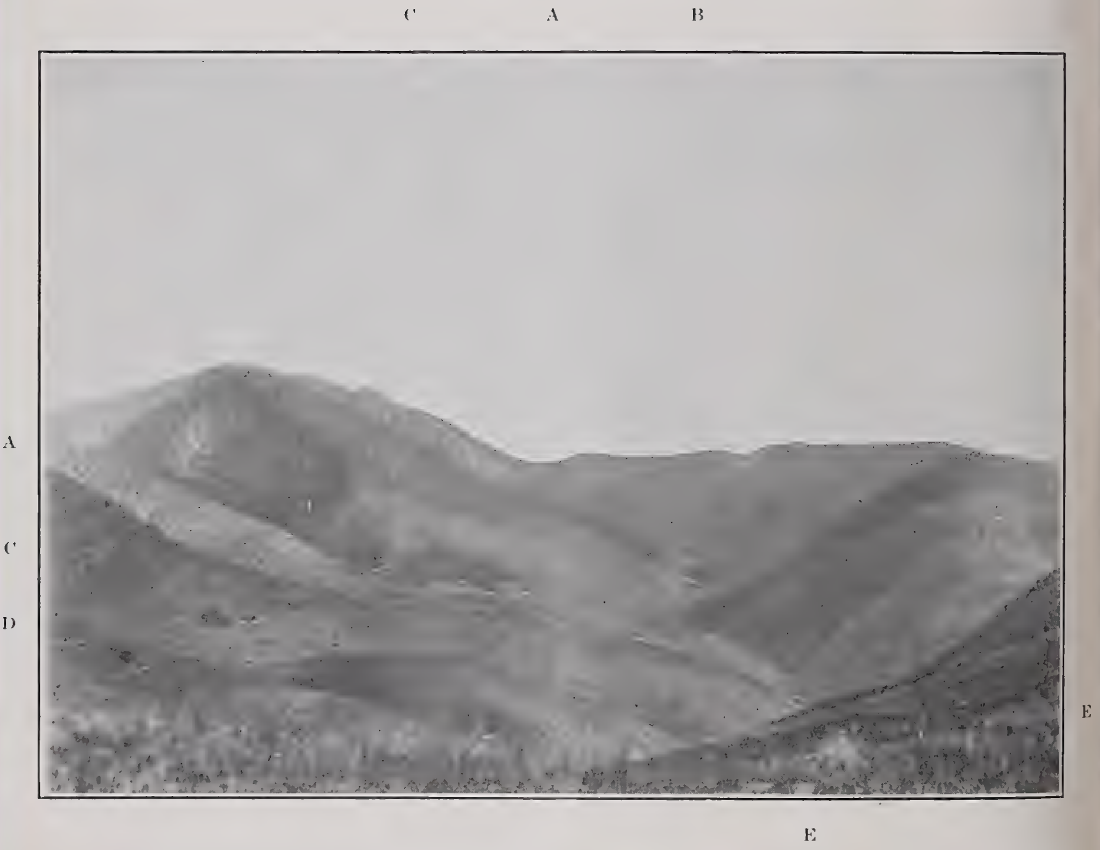

Plate VI. Romans Kraal valley in the division of Uniondale. The lowest saddle on the sky line, A.A., is Schuurberg's Nek over which the old track enters the valley from the west, and descends to, and follows, the Jigukamma which is the stream on the right coming straight down, under B. The track then leaves the stream to ascend the ridge on which is Romans Kraal. Romans Kraal shows, at C.C., as a cleared patch with some bushes about it. The continuation of the track is visible at D, where it goes out of the picture, but can be traced back over the front ridge, and again at the left of Romans Kraal. From near D the track finally curves northwards to emerge at Romans Kraal Nek, from which the photograph was taken. At E.E. the Jigukamma turns sharply to the north, and enters the gorge at the right-hand bottom of the picture, to join the Keurbooms River at De Vlugt.

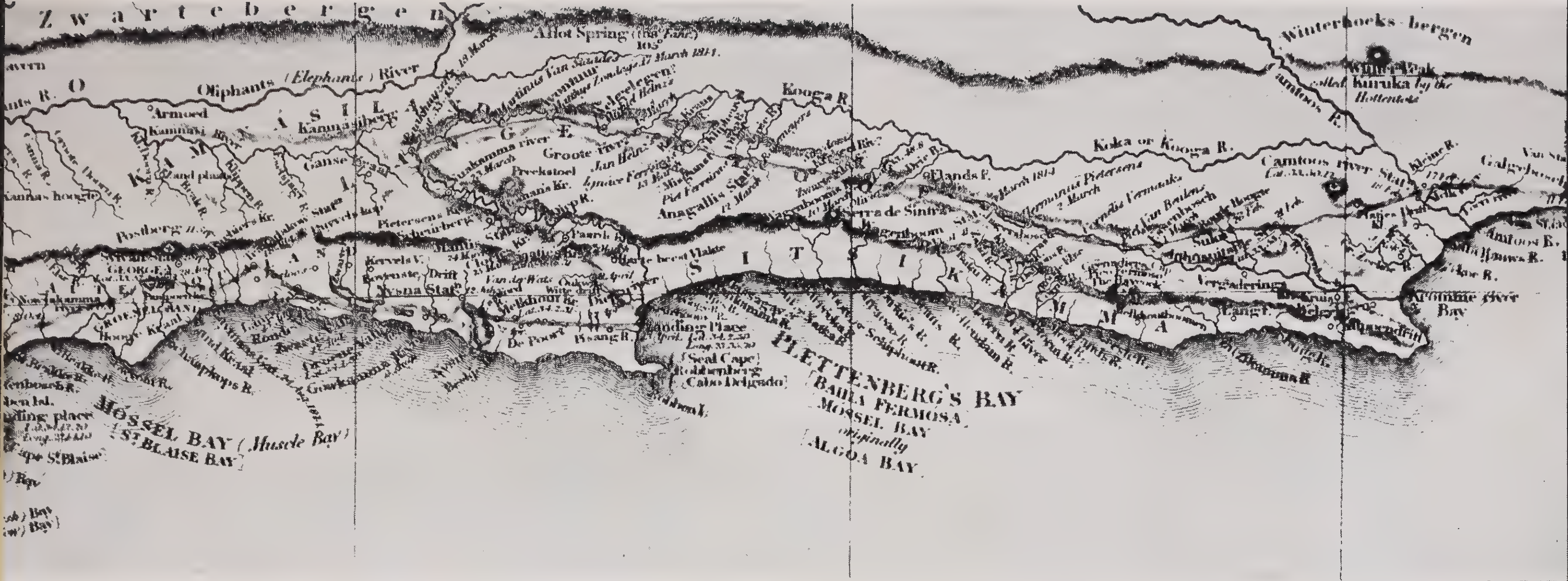

PLATE VII. Extract from Burchell's map of his route, in vol. 1 of the *Travels*. Burchell's stations are marked by circles with a central dot. Farm houses by circles without the dot. His route from station to station is indicated by lines of fine dots, over which a stripe has been hand-coloured carelessly, missing the dots in many places. The dotted lines join the stations consecutively, and, occasionally, take up farm houses on the way, but they do not represent the actual tracks which may be much more circuitous. Burchell gives two scales on his map, one, for map distances, of 69½ miles to a degree of latitude, which works out to about 1/1,520,000, and the other, for road distances, of 90 miles to a degree, that is, on an average, 13 miles of track for every 10 miles of map distances. The latitudes of the map are quite good; the absolute longitudes not so good, as could only be expected of a traveller not equipped with a battery of chronometers, in days that had no wireless. Nevertheless, in the section reproduced, the errors in longitude are within a minute of time, and being fairly constant, do not affect the mapping. On the whole, Burchell's map was wonderfully accurate for its day, and a great advance on anything that had preceded it.

# INDEX OF PLANT NAMES.

PAGE
Acrostemon Klotz. .. .. .. 70
Agropyron repens .. .. .. 38
,, spicatum .. 39, 54
,, tenerum .. .. 39
Agropyrum distichum .. .. 156
Agrostis alba .. .. .. 37
,, capillaris .. .. .. 38
Allenia Phillips .. .. .. **33**
,, urens (Linn.f.) Phillips **33, 34**
Andromeda Linn. .. .. .. 69
Andropogon furcatus .. .. 37
,, scoparius .. .. 37
Aniserica N.E.Br. .. .. .. 70
Anomalanthus Klotz. .. 70, 71
Anthericum albucoides Ait. .. 113
,, congestum Adamson.. **133**
,, Giffenii Leighton **58, 59**
,, hispidum L. .. .. 134
,, longepedunculatum Steud. .. .. 134
,, pilosum Baker .. 59
Apodytes dimidiata .. .. 153
Arachnocalyx Compton .. .. 70
Ardernia Salisb. .. .. .. 86
Arthrosolen C.A.Mey. .. 62, 67
,, deserticola (Gilg) Compton .. .. .. 63
,, fraternus N.E.Br. .. 63
,, gymnostachys C.A. Mey. .. .. 63
,, inconspicuus Meisn. .. 63
,, laxus C.A.Mey. .. 63
,, microcephala (Meisn.) Phill. .. .. **63**
,, ornatus Meisn. .. 63
,, phaeotrichus C.H.W. 63
,, polycephalus C.A.Mey. 61, 62
,, spicatus C.A.Mey. .. 63
,, variabilis C.H.W. .. 63
Aspalathus ciliaris Benth. .. 145
,, intricatus Compton .. **8**, 9
,, oxycladus Compton .. **9**
,, rubrocalyx Compton .. **9**
Aspasia Salisb. .. .. .. 86
,, aureum Salisb. .. .. 88
,, flavescens Salisb. .. .. 88
,, lactea Salisb. .. .. 102
,, thyrsoides Salisb. .. .. 97
Athanasia obtusa Compton .. **6**, 7
,, spathulata Harv. .. 8

Basutica Phillips .. .. **64**, 67
,, aberrans (C.H.W.) Phill. 63, **64**
Beryllis Salisb. .. .. .. 86
Blaeria Linn. .. .. 70, 71 **72**
Bouteloua curtipendula .. .. 37
,, gracilis .. .. .. 37
Brachiaria serrata .. 41-46, 48-52
Brizophila Salisb. .. .. .. 86
Bromus carinatus .. .. .. 39
,, inermis .. .. .. 37
Buchloe dactyloides .. .. 37
Buddleia salvifolia .. .. .. 153
Bulbilis dactyloides.. .. .. 37

Calluna vulgaris .. .. .. 80
Cassine crocea .. .. .. 153
,, velutina .. .. .. 153
Catha edulis Forsk. .. .. 155
Cathissa Salisb. .. .. .. 86
Cnidium suffruticosum .. .. 156
Coccosperma Klotz. .. .. 70
Coilostigma Klotz. .. .. 70, 71
Cotula montana Compton.. .. **124**
Cryptadenia Meisn... .. .. 67
Cunonia capensis .. .. .. 153
Curtisia faginea .. .. .. 153

Dactylis glomerata .. .. .. 38
Dais Linn. .. .. .. .. 67
Digitaria tricholaenoides 41, 42, 44-53
Drosera curviscapa Salter .. 60
,, ,, ,, var.

Esterhuysenae Salter .. .. **60**
Eleogiton rubicundus Nees .. 26
,, striatus Nees .. .. 25
Elsiea Leighton .. .. .. **55**
,, corymbosa Leighton **56, 57**
,, Flanaganii (Bak.) Leighton **57**
Elymus ambiguus .. .. 39, 54
Englerodaphne Gilg .. 65, 67
,, ovalifolia (Meisn.) Phill. .. .. **65**
,, pilosa Burtt Davy 65
Eragrostis chalcantha .. 41-52
Eremia D.Don .. .. 70, 71, **72**
Eremiopsis N.E.Br. .. .. 70
Erica Linn. .... .. .. 69, 70, 71
,, speciosa Andr. .. .. 145
Ericinella Klotz. .. .. .. 70
Eustachys Salisb. .. .. .. 86

Festuca duriuscula .. .. .. 38
,, pratensis .. .. .. 38
,, rubra .. .. .. 38
Ficinia Ecklonea Nees .. .. 29

Gnidia Linn... .. .. 62, 67
,, aberrans C.H.W. .. 61, 63, 64
,, anomala Bolus .. .. 61

PAGE
Gnidia anomala Meisn. .. 62, 63, 64
,, cephalotes Licht. ex Meisn. 65, 66
,, fastigiata Rendle .. .. 61
,, fraterna (N.E.Br.) Phill. .. **63**
,, gymnostachya (C.A.Mey.) Gilg .. .... .. 63
,, Harveyana Meisn. .. .. 62
,, laxa (Linn.f.) Gilg .. .. 63
,, meisneriana Phill. .. .. **63**
,, microcephala Meisn. 62, 63
,, ovalifolia Meisn. .. .. 65
,, phaeotricha Gilg .. .. 63
,, pulvinata Bolus 61, 63, 65, 66
,, spicata (Linn.f.) Gilg .. 63
,, variabilis (C.H.W.) Phill. .. **63**
,, vesiculosa E. & Z. .. .. 63
Grisebachia Klotz. .. .. .. 70

Haworthia baccata G. G. Smith 19, **20**
,, Beanii G. G. Smith **137**, **138**, 140
,, ,, ,, var. minor G. G. Smith **138**, **139**
,, Chalwinii Marl. & Berger .. .. 21
,, cordifolia Haw. .. 138
,, cymbiformis Haw. .. 24
,, ,, ,, var. multifolia Triebn. .. 22
,, Dekenahii G. G. Smith **140**, **142**
,, lepida G. G. Smith **21**, **23**
,, ramosa G. G. Smith **22**, **23**
,, Reinwardtii Haw. 14, 16
,, ,, var. adelaidensis v.P. 17
,, ,, var. brevicula G. G. Smith **11**, **13**
,, ,, var. fallax v.P. 143
,, ,, var. grandicula G. G. Smith **12**, **13**
,, ,, var. huntsdriftensis G. G. Smith **14**, **16**
,, ,, var. olivacea G. G. Smith .. **142**
,, ,, var. riebeekensis G. G. Smith **16**
,, ,, var. zebrina G. G. Smith **18**, **19**
,, retusa (L.) Haw. .. 142
Hermannia intricata Adamson .. 123
,, ,, Engl. .. 123
,, micrantha Adamson .. **123**
,, Preslyana Turcz. .. 123
,, prismatocarpa E.Mey. 123
,, rugosa Adamson .. **123**
,, salviaefolia L... .. 145
Hessea Chaplinii Barker **130**, **131**
,, gemmata Benth. .. .. 131
,, Leipoldtii Bolus .. .. 131

PAGE
Hexastemon Klotz... .. 70, 71
Hibiscus cucurbitinus Burchell .. 34
,, urens Linn.f. .. 33, 35
Holcus sorghum sudanensis .. 37

Ilex mitis .. .. .. .. 153
Indigofera digitata B. .. .. 145
,, flabellata Harv. .. 145
Iphiona dentata Bolus .. .. 126
,, integra Compton .. **125**, **126**
Isolepis Thunbergiana Nees .. 29

Koeleria cristata .. .. .. 37

Lachnaea Linn. .. .... .. 67
Lachnopylis floribunda .. .. 153
Lagenocarpus Klotz. .. 70, 71
Lasiosiphon Fresn. .. .. 62, 67
,, deserticola (Gilg) C.H.W. .. .. .. 63
,, linifolius Dcne. .. 62
Lepterica N.E.Br. .. .. 70, 71
Lolium italicum .. .. .. 38
Lolium perenne .. .. 38, 54

Macnabia Benth. .. .. .... 69
Melasma scabrum Berg. .. .. 145
Microtrema Klotz. .. .. .. 69
Monotassa secunda Salisb. .. 117
Muhlenbergia gracilis .. .. 54
Myanthe Salisb. .. .. .. 86
Myrica diversifolia Adamson .. **128**
,, humilis Ch. & Sch. .. 129
,, incisa Chev... .. .. 129
,, quercifolia L. .. .. 129
,, Zeyheri C.DC. .. .. 129

Nabia Lehm. .. .. .. 69

Ocotea bullata .. .. .. 153
Olea laurifolia .. .. .. 153
Ornithogalum Linn. .. 83, **86**
,, aestivum L. Bolus 102
,, aethiopicum .. 83
,, albucoides Thunb. 113
,, alticolum Leighton 87, **93**, 94, **95**, **98**
,, arabicum 84, 86, 102
,, aurantiacum Baker 108
,, aureum Andr. .. 110
,, ,, Curt. .. 87
,, ,, Red. .. 90
,, barbatum Jacq. 112,114
,, bicolor Haw. .. 97
,, Brownleei Leighton 87, 89, **91**
,, ceresianum Leighton 87, **92**, **95**, **98**
,, cinnamomeum Leighton 112, 113, **121**, **122**
,, coarctatum Jacq. .. 97
,, Comptonii Leighton 112, 113, **121**, **122**

PAGE

Ornithogalum conicum Jacq. 87, **103,** 105, **106**
,, ,, ,, var. strictum (L. Bolus) Leighton **103, 104**
,, crenulatum L.f. 112, 113, **121**
,, epigeum Leighton 112, 113, **118, 120**
,, Fergusoniae L. Bolus 87, **89, 91**
,, fimbrimarginatum Leighton 87, **103, 105, 106**
,, flavescens Jacq. .. 87
,, flavissimum Jacq. 87, 89, **90, 91**
,, Hermannii Leighton 87, **93, 95, 98**
,, insigne Leighton .. 110
,, lacteum Jacq. 83, 85, 87, **102,** 103, 105, **106**
,, ,, Jacq. Bot. Mag. .. .. 103
,, ,, ,, var.
,, ,, conicum Bak. .. 103
,, ,, Lodd. .. 96
,, Leipoldtii L. Bolus. 87, **94, 95,** 96, 97, 98
,, maculatum Jacq. 87, **106, 108, 109**
,, ,, var. speciosum
,, ,, (Bak.) Leighton **106, 109, 110**
,, ,, var. splendens (L. Bolus) Leighton **106, 109, 110**
,, maculatum Thunb. 117
,, miniatum Jacq. **87, 89,** 90, **91, 94**
,, ,, var. Vandermerwei (Barnes) Leighton **89, 91**
,, ,, Kunth .. 88
,, Muirii Leighton 111, **113, 115**
,, multifolium Bak. 87, **106, 107**
,, nanodes Leighton 112, 113, **118, 119**
,, neapolitanum .. 83
,, odoratissimum C. A. Smith .. .. 116
,, odoratum Andr. .. 117
,, ,, Jacq. 111, 113, **115, 116**
,, Pearsonii Leighton 111, **112,** 113, **115**

PAGE

Ornithogalum Pillansii Leighton .. 87, **95, 96,** 97, **98**
,, polyphyllum Jacq. 111, 113, **115, 116**
,, pruinosum Leighton 87, **103, 104, 106**
,, pygmaeum A. V. Duthie .. .. 119
,, pyrenaeum .. .. 83
,, ranunculoides L. Bolus 87, **106, 107**
,, revolutum Jacq. 94, 96
,, Roodiae Phill. 113, 114
,, rupestre L.f. 87, 106, **107, 108**
,, sanguineum Kunth 116
,, secundum Jacq. 111, 113, **115, 117**
,, ,, var. latifolium L. Bolus 113, 117
,, solitarium Leighton 112, 113, **120, 121**
,, speciosum Baker .. 110
,, splendens L. Bolus .. 110
,, strictum L. Bolus .. 104
,, suaveolens Jacq. 111, **112,** 113, 114, **115,** 116
,, subcoriaceum L. Bolus 87, **91, 92,** 106
,, thunbergianum Bak. 109, 110
,, thyrsoides Jacq. 84, 85, 87, **97, 98, 100** 102
,, ,, var. flavescens Lindl. .. 88
,, var. miniatum Bak... .. 88
,, ,, Saund... .. 96
,, tortuosum Bak. 111, 113, **118**
,, tuberosum Bak. .. 116
,, umbellatum. L. 83, 86
,, unifolium Dyer .. 120
,, ,, Retz. .. 122
,, Vandermerwei Barnes .. .. 89
Osmyne Salisb. .. .. .. 86

Panicum virgatum .. .. .. 37
Passerina Linn. .. .. .. 67
Peddiea Harv. .. .. .. 67
Pelargonium peltatum Ait. .. 145
Pentaschistis capensis (Nees) Stapf 135
,, natalensis Stapf 135
,, silvatica Adamson .. **134**
Peperomia retusa A. Dietr. .. 145
Phaeocles Salisb. .. .. .. 86
,, maculata Salisb. .. 109
Phalangium albucoides Poir. .. 113

PAGE
Phalaris tuberosa .. .. 37, 54
Philippia Klotz. .. .. .. 70
Phleum pratense .. 37, 38, 54
Phycomyces Blakesleeanus .. 78
Pinus nigra .. .. .. .. 80
,, sylvestris .. .. .. 80
Platycalyx N.E.Br... .. 70, 71
Platylophus trifoliatus .. .. 153
Plectronia Mundiana .. .. 153
,, ventosa .. .. .. 153
Poa pratensis .. .. 37, 38
Podalyria Burchellii DC. .. .. 145
Podocarpus falcatus .. .. 153
,, latifolius .. .. 153
Protea lacticolor Salisb. .. .. 6
,, longifolia Andr. .. 2, 4
,, ,, var. minor Phillips 2
,, minor Compton .. .. **1, 3**
,, venusta Compton .. .. **4, 5**
Pseudognidia Phillips .. **63,** 67
,, anomala (Meisn.) Phill. .. 63, **64**
Pterocelastrus tricuspidatus .. 153

Salaxis Salisb. .. 70, 71, **73**
Scirpus antarcticus L. .. .. 28
,, brevicaulis Levyns .. **31**
,, bulbiferus Boeck. .. .. 25
,, capillifolius Parl. .. .. 25
,, cartilagineus (R.Br.) Poir. 28
,, cernuus Vahl. .. .. 29
,, chlorostachyus Levyns .. **29**
,, delicatulus Levyns **30, 31**
,, digitatus (Schrad.) Boeck. 29
,, Dregeanus C.B.Cl. .. 25
,, Ecklonii Steud. .. .. 29
,, flaccidifolius Steud. .. 29
,, globiceps C.B.Cl. .. .. 26
,, Holoschoenus L. var. Thunbergii C.B.Cl. .. .. 28
,, Hystrix Thunb. .. .. 32
,, inconspicuus Levyns **30, 31**
,, Isolepis Boeck. .. .. 25

PAGE
Scirpus membranaceus Thunb. .. 29
,, nanodes Levyns .. .. **29**
,, nodosus Rottb. .. 29, 30
,, rubicundus (Nees) Levyns **25, 26,** 27
,, striatus (Nees) Fourcade 25, 26, 27
,, tenuis Spreng. .. .. 29
,, tenuissimus Boeck. .. 26
,, Thunbergianus (Nees) Levyns .. .. **28,** 29
,, Thunbergii (Schrad.) Boeck. 29
Scyphogyne Brongn. .. 70, 71, **72**
Senecio elegans .. .. .. 156
,, Hollandii Compton .. **126**
Simocheilus Klotz. .. .. 70
Sorghum halepense .. .. 37, 54
Stilbe mucronata N.E.Br... .. 128
,, phylicoides A.DC. .. .. 128
,, rupestris Compton .. .. **127**
Stipa spartea .. .. .. 37
Strumaria Salteri Barker .. **131, 132**
,, Watermeyeri L. Bolus 133
Struthiola Linn. .. .. .. 67
Struthiolopsis Phillips .. **64,** 67
,, Bolusii Phillips .. **65**
,, pulvinata (Bolus) Phill. .. 63, **65**
Sympieza Licht. .. .. 70, 71
Syndesmanthus Klotz. .. 70, 71

Taeniola Salisb. .. .. .. 86
Thamnus Klotz. .. .. .. 70
Thoracosperma Klotz. .. .. 70
Trachypogon plumosus .. 41-52
Trichocladus crinitus .. .. 153
Tristachya hispida .. .. 41-52

Urginea pedunculata Adamson .. **134**
,, secunda Bak. .. .. 117
Urophyllon Salisb. .. .. .. 86

Vaccinium Linn. .. .. 70, 71